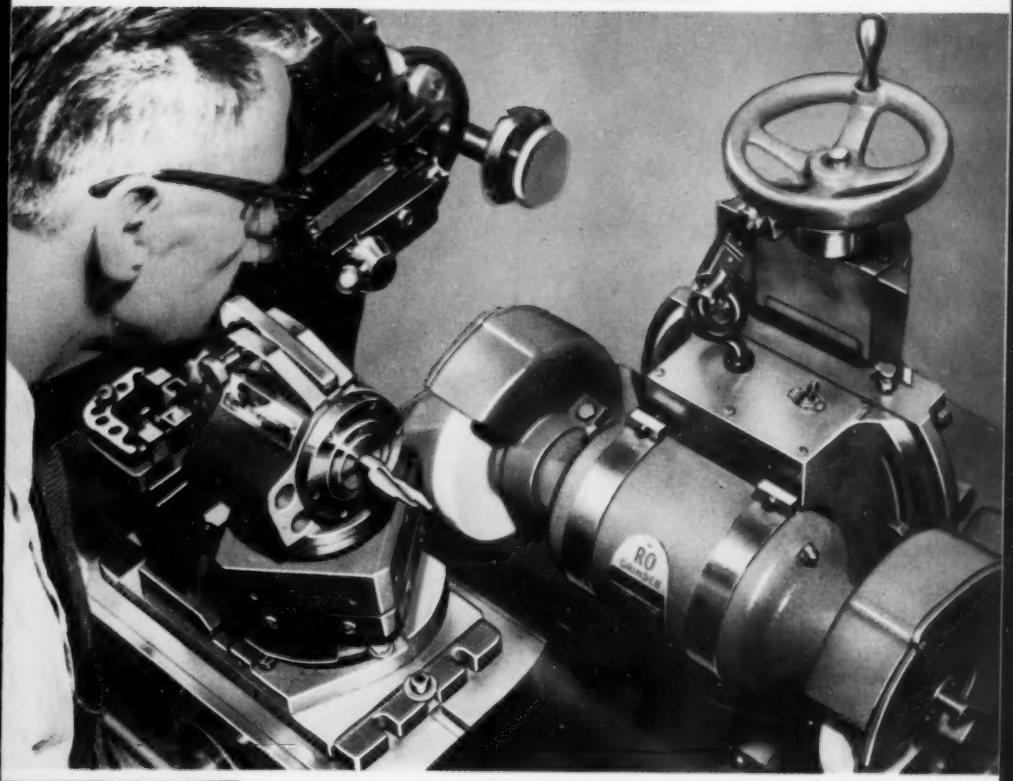
modern machine shop

MACHINING SPACE VEHICLE PARTS
See Page 108

COLD EXTRUDING STEEL ALLOYS
See Page 126

OCTOBER 1959



RO
UNIVERSAL FORM RELIEVING FIXTURE

ARE YOU *SHARPENING* YOUR CUTTING TOOLS...
OR GRINDING AWAY THEIR LIFE?

R-O Grinder

SEE PAGE 19

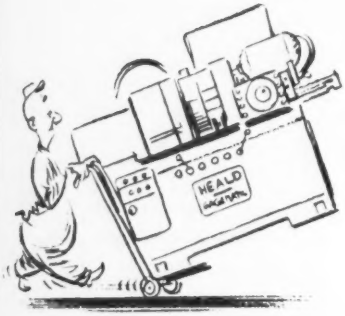
WHY WAIT

longer

for a new machine?

Chances are, Heald has it

IN STOCK!



As a result of Heald's recently instituted stock machine program, the most popular types and sizes of Heald precision finishing machines are normally carried in factory stock at Worcester. Any time you can buy a *stock machine*, and supply your own fixtures and tooling, you get these important advantages . . .

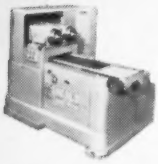
1. FAST DELIVERY. Instead of waiting for several months for a specially built machine, your stock machine will be on its way in a matter of days or weeks.

2. LOWER COST. By eliminating special engineering and drafting, you get a top-quality basic machine at lowest possible cost.

3. UNLIMITED VERSATILITY. Every Heald stock machine has the inherent versatility of speeds, feeds and cycling that permits easy adaptability to virtually any combination or sequence of operations.

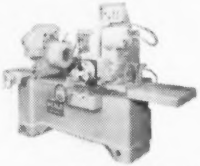
If you need a standard machine in a *hurry* — and at minimum cost — it will pay you to check Heald on the availability of a *stock machine* that will meet your requirements.

THESE STANDARD HEALD MACHINES ARE NORMALLY CARRIED IN STOCK



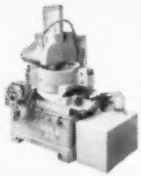
BORE-MATICS

Model "0" Model 421
Model 121 Model 222
Model 221 Model 322
Model 321 Model 422



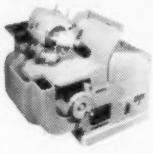
INTERNAL GRINDERS

Model 171 Size-Matic
Model 171 Gage-Matic
Model 271 Plain
Model 271 Size-Matic
Model 271 Gage-Matic
Model 271 Tool Room
Model 272 Basic
Model 273A Universal



ROTARY SURFACE GRINDERS

Model 161 6"
Model 261 16" Plain
Model 261 16" Automatic
Model 361 24" Plain
Model 361 24" Automatic



TOOL SHARPENING MACHINES

Model 3
Model 4

HEALD

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York • Syracuse

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modern machine shop

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BPA

A Statement of Policy

The principal function of MODERN MACHINE SHOP is to search out and disseminate the best and newest ideas for the advancement of engineering skill and mechanical efficiency in the metalworking industry, and neither effort nor expense is, or shall be, spared in the performance of this task.

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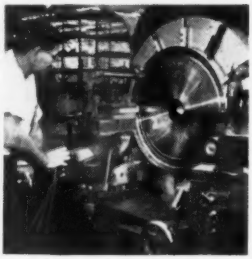
modern machine shop

features in

Assembling & Finishing... Inspecting, Testing & Control... Press Working... Management & Safe Practices... Materials & Processes... Production Machining... Tooling & Design

MACHINING PARTS FOR SPACE VEHICLES

By Howard Campbell



Pratt & Whitney Aircraft's new Research and Development Center located near West Palm Beach, Florida, has facilities that are devoted entirely to the development, building and testing of new jet and rocket engines for use in aircraft and space vehicles.

Page 108

HOW TO SOLVE YOUR SUPERVISORY PROBLEMS

By Alfred M. Cooper

In this month's column, Mr. Cooper discusses the importance today of management giving thought to an employee's seniority rights.

Page 114

HOW TO DESIGN A HOT PLATEN FOR METAL BONDING

By William P. Engler

The techniques discussed are intended to solve those problems most frequently encountered in designing equipment for mass producing bonded parts.

Page 116

SELECTING A TAPE CONTROLLED MACHINE TOOL

By E. Panfil

Discussion covers a study conducted by General Electric's Ordnance Department for equipping new plant with most economical and practical machine to produce prototype inertial guidance equipment.

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this issue

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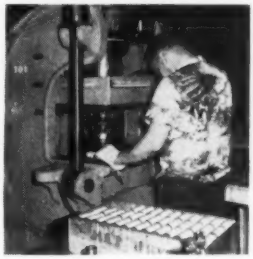
COLD EXTRUDING STEEL ALLOYS TO PRECISION

By Gilbert C. Close



This field report illustrates and describes in interesting detail how the Matthews Manufacturing Company uses cold extruding process to produce steel alloy parts of practically any desired configuration to close dimensional tolerances and high surface finishes.

Page 126

MACHINING STAINLESS STEEL

By G. J. Stevens

Reduction in end mill overhang, together with modification of work-holding method, solves poor tool life problem in slotting stainless valve bodies.

Page 132

PRACTICAL POINTERS FOR PROFITABLE HEAT TREATING

By A. S. Eves

Continuing his discussion of heat treating procedures, the author presents time and money-saving suggestions for minimizing distortion in heat treatment.

Page 136

MORE PRODUCTION THROUGH MODERNIZATION

Featured this month in our regular department devoted to discussing techniques for increasing output with newly machines and tools are case-history articles on grinding, reaming and chamfering, drilling, broaching and boring.

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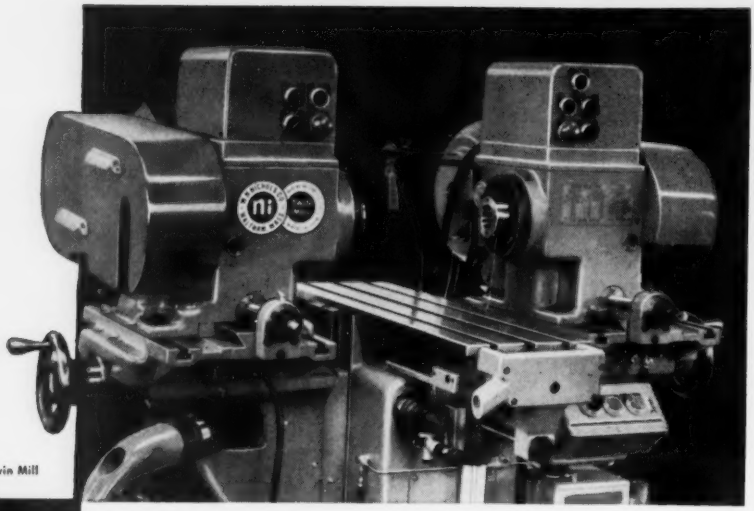
modern machine shop



Twin Mill

NICHOLS MILLERS . . .

Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

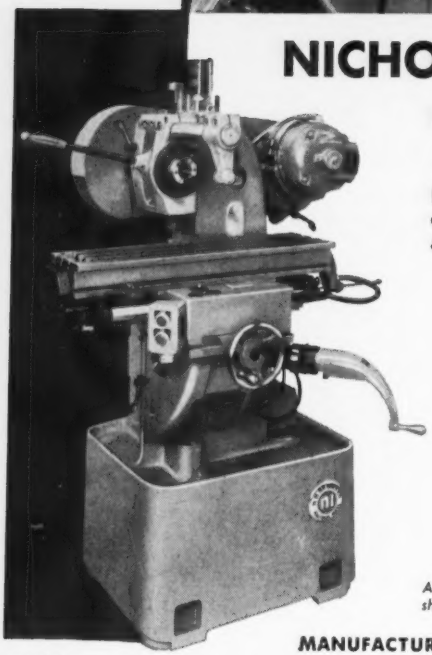
The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic down-feed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you?



Nichols 85A
Semi-automatic

MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors **THE ROBERT E. MORRIS COMPANY**

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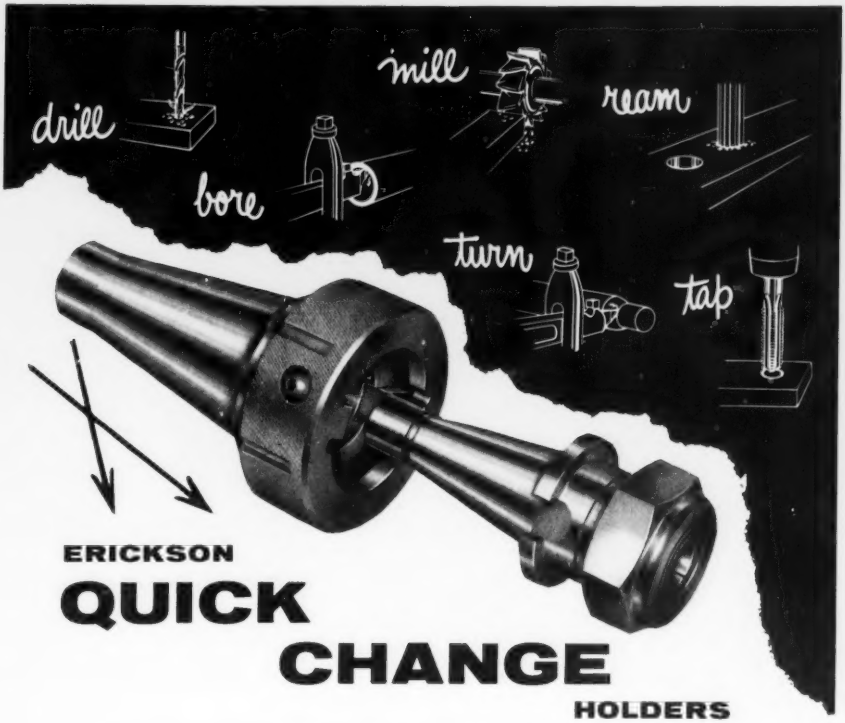

ERICKSON

QUICK CHANGE

HOLDERS

...for use with your standard MMS tapered tools ...designed for presetting of tools

Now you can use your present standard MMS tapered tools with the *new* Erickson Quick Change Holders. That means you get the double production advantage of Erickson's *high precision coupled with the rapid change feature.*

Several different models comprise the line: Morse taper holders for boring mills and radial drills, milling machine holders that fit standard spindle tapers, turret lathe holders that increase turret lathe tool-holding capacity, straight shank holders with #30 or #40 MMS socket. These holders take Erickson Collet Chuck milling machine adapters in both regular and heavy duty types, end mill adapters, shell and face mill adapters, Morse taper adapters, boring head adapters, and chuck adapters for Jacobs internal taper.

A call or card will bring the Erickson representative on the double. Meantime write for your copy of Catalog G "Erickson Quick Change Holders."

ERICKSON TOOL COMPANY

34455-10 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

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NEW

WARNER & SWASEY

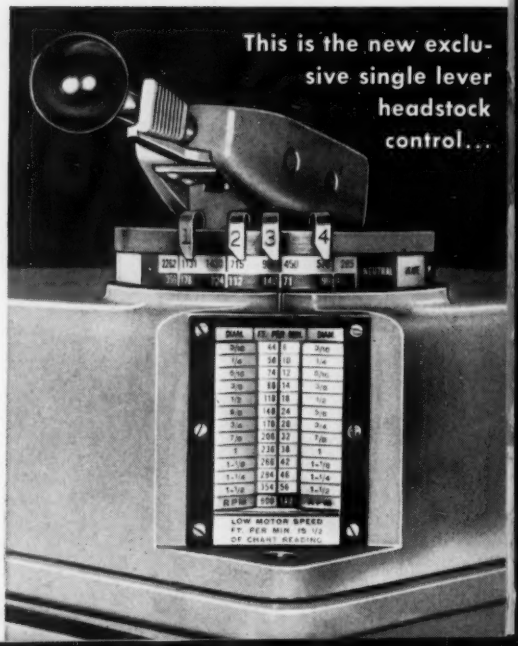
Unique, Automatic Headstock

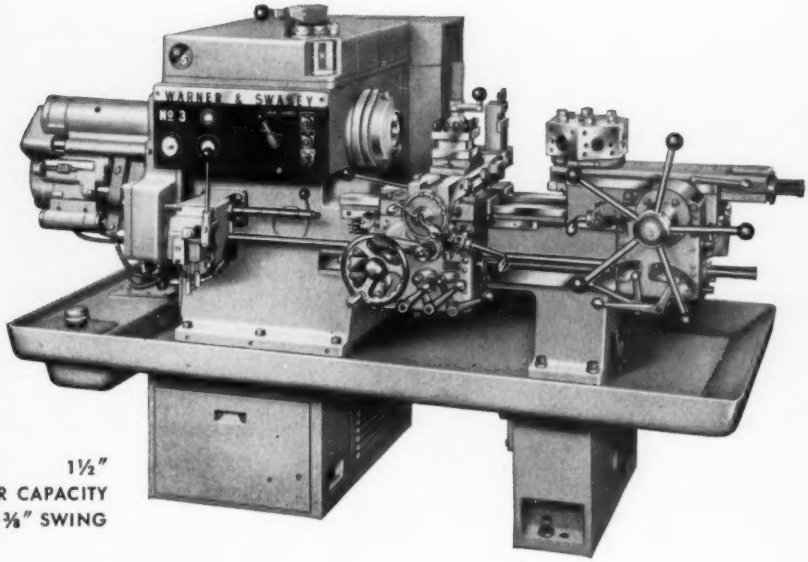
More Speeds—Greater Range—The new eight-speed headstock (16 with a two-speed motor) gives you more speeds in a wider range—from 45 to 2262 rpm—for maximum metal removal efficiency.

Instant Speed Changes are made possible through exclusive, Warner & Swasey designed direct-acting hydraulic clutches (which never need adjustment) in combination with a constant mesh, helical gear train.

Full Power is always available at the spindle nose. Higher-powered motor is direct-mounted to eliminate drive maintenance problems.

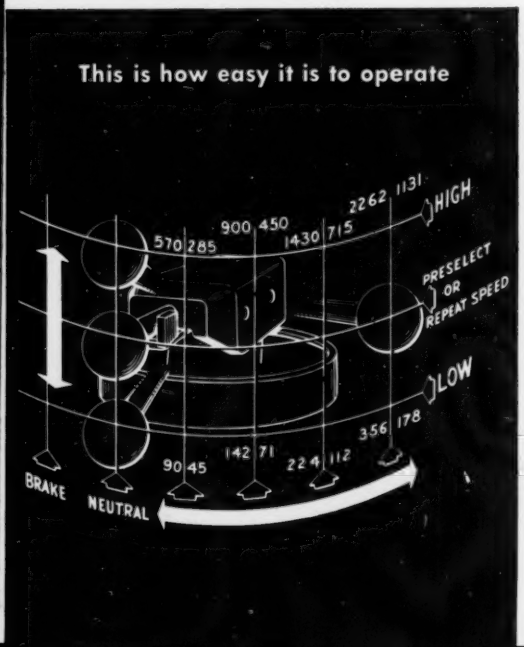
You can produce it better, faster, for less... with a WARNER & SWASEY





1½"
BAR CAPACITY
15⅜" SWING

No.3 ram type turret lathe



Exclusive, Single Lever Preselector and Speed Control

On the new No. 3, preselection of speeds, speed change, brake and neutral are all obtained with the same lever.

No fumbling for speeds... no gear shifting. Just rotate the handle to preselect; move it up or down to engage new speed instantly.

No figuring... the direct reading preselector dial tells you the surface speed for each diameter and rpm.

No remembering (or forgetting)... the preselector drum lets you set up sequence of cuts; numbered clips tell you where to find the speeds and their order of use.

Neutral (free spindle) and Brake are selected by rotating lever to the left.

Warner & Swasey Co.
Cleveland 3, Ohio

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Which backing would you specify ...and why?

In the above picture, the backing on the abrasive belt at right is Jeans, a lightweight, flexible cloth used chiefly in woodworking applications. The Drills cloth backing on the left is a heavy, extremely durable cloth used for all types of metal grinding operations. They are but two of many different types and weights of cloth, paper, fibre, and combination backing materials. Choosing the *right* one for your particular application can make a big difference in your product finishing costs. Which is why more and more manufacturers turn to the expert recommendations of Jewel Brand Abrasives Engineers. If the right choice is up to you, call on them for the backing you need. Write for details. Abrasive Products, Inc., 507 Pearl Street, South Braintree, Mass.

belts
rolls
sheets
discs
specialties

JEWEL BRAND

COATED ABRASIVES

ABRASIVE PRODUCTS, INC., South Braintree 85, Massachusetts

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when your fastening job calls for
INTERNAL WRENCHING

Apex one-piece power bit, to drive socket head screws. ¼" to ⅝" hex shanks. For #5 to 1" cap screws; #10 to 1" set screws.

APEX

Apex special driver for internal wrenching nut with threaded hole.

INTERNAL WRENCHING TOOLS
STANDARD • MAGNETIC • SPECIAL

Write, on your company letterhead please, for

Catalog 30-A—Standard & Magnetic Nut Running Tools. ¼" to ⅝" sq. dr.

Catalog 30-B—Standard & Magnetic Nut Running Tools, ¾" to 3½" sq. dr.

Catalog 30-C—Standard & Magnetic Screwdriving Tools

Catalog 30-D—Miscellaneous Fastening Tools

Apex magnetic bit holder and insert bit, to drive socket head screws. Full range of standard and magnetic holders. Inserts for 1/16" to ½" cap screws; #5 to ¾" set screws.

APEX FASTENING TOOLS
SCREWDRIVING • NUT RUNNING • SPECIAL

The APEX Machine & Tool Co. • 1027 So. Patterson Blvd. • Dayton 2, Ohio

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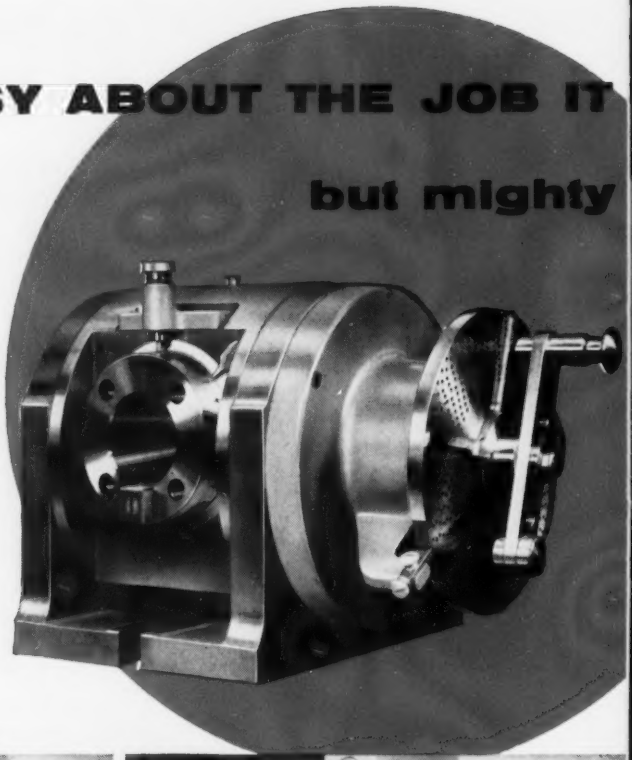
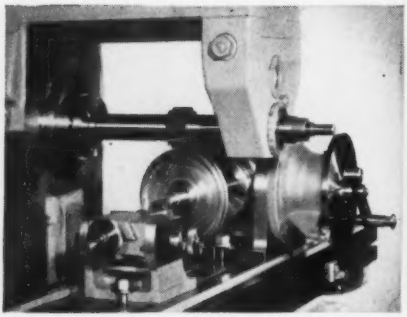
NOT FUSSY ABOUT THE JOB IT

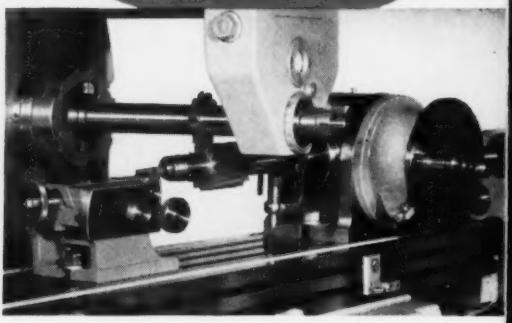
but mighty

CINCINNATI





CINCINNATI Dividing Head setup on a Dial Type Milling Machine for hobbing the teeth of a worm wheel.



Milling a helical tooth gear. CINCINNATI Dividing Heads are ruggedly constructed for work of this type.

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

DOES . . .

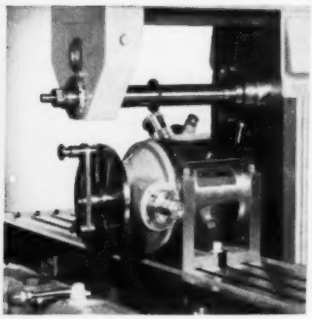
particular about ACCURACY

CINCINNATI Dividing Heads are precision tools, versatile in both toolroom and production work.

Handy man for milling machines, CINCINNATI Dividing Heads are not a bit fussy about the work assigned to them. They handle prosaic jobs like milling slots in adjusting nuts; heavy duty work like milling worms or the flutes in cutters; accurate and intricate jobs like bevel gears. Light cuts or heavy cuts, you can depend upon CINCINNATI Dividing Head's high degree of accuracy.

These illustrations are typical of the many ways in which CINCINNATI Dividing Heads can handle work in your shop. They are not restricted to universal millers; they are equally at home on plain and vertical milling machines and drill presses. And your inspectors will find 1001 uses for them in checking the accuracy of work.

CINCINNATI Dividing Heads are built in 8″, 10″, 12″ and 14″ sizes; all have 40 to 1 ratio. Complete data may be obtained by writing for catalogs No. M-1924-2 and M-1969.



Milling a straight tooth bevel gear by predetermining angle of roll and amount of set-over with CINCINNATI Dividing Head.

CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI
MILLING MACHINE DIVISION

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SEE FOR YOURSELF

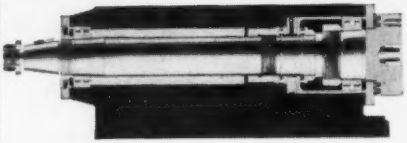
why you can be sure of...

- **LOW MICROINCH SURFACE FINISHES**
- **TOLERANCES DOWN IN THE MILLIONTHS**
- **INCREASED PRODUCTION**
- **LOWER COSTS**

when you specify... **POPE PRECISION SPINDLES**

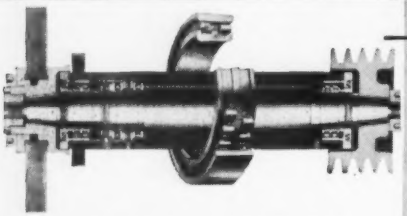
FOR SURFACE GRINDERS—

POPE 1, 2 and 3 HP, Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with massive shafts and big, double row cylindrical roller bearings having enormous capacity, superior performance and long life.



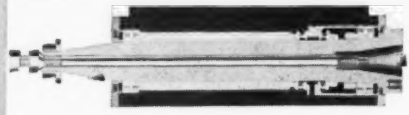
FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles for smooth, chatter free, continuous high production of accurate parts. Again, look at the big cylindrical roller bearings and thrust bearings.



FOR CYLINDRICAL GRINDING—

POPE Cartridge Type and Wheel Head Belt Driven Spindles with the capacity to produce more work whether you plunge grind with a crush dressed wheel, remove surplus metal, or produce low microinch surface finishes. Note the super-precision radial bearings and ball thrust bearings.



FOR HEAVY DUTY MILLING—

POPE Spindles have the double row cylindrical roller bearings for the extra rigidity to support the cutting tool, and the double direction thrust bearings with the excess capacity to stabilize the shaft against endwise movement in either direction. This adds up to longer cutting tool life, more production, lower cost per piece.

POPE engineers and builds standard and special, precision anti-friction bearing Spindles for every purpose. Send us your specifications for prompt quotations.

No. 115

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

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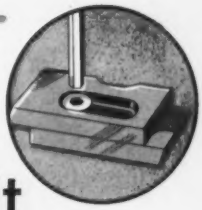
replaceable boring and reaming cutters

adjust to fit the hole!



Save 70% or more in tool costs and production time on holes over 5/8"

● Diameter adjustable within 1/4 in. range: Blades are expandable *as they wear* for maximum tool life and accurate tolerance control. Grind blades for tolerance *only; not* for size.

● Blades replaceable: Madison slotted bars wear indefinitely. You replace blades only, with costs averaging 1/3 that of solid flute reamers. Down-time for replacement and adjustment is negligible.

● Cut tool inventory: *One* Madison slotted bar can be used on holes of *many* varied diameters... since each bar accommodates a broad range of cutter sizes.

● No alignment problem: Madison reamer blades *float* in the bar slot... are self-centering in the hole. No floating holders required, no compensation for spindle wear. (NOTE: *Boring* cutters are *fixed* in their slots... do *not* float.)

● Free cutting action, no chip pack-up: Generous chip clearance permits free circulation of coolant for higher speeds, finer finishes, closer tolerances.

● Multiple operations in one pass can be performed simply by spacing standard Madison blades on specially made bars. Any combination of reaming, boring, chamfering and other hole-making jobs can be completed on a *variety of diameters* ... and in *one pass!*

Write for further information to

MADISON *Industries*

Dept. MR10, Box 1137
Providence, R. I.

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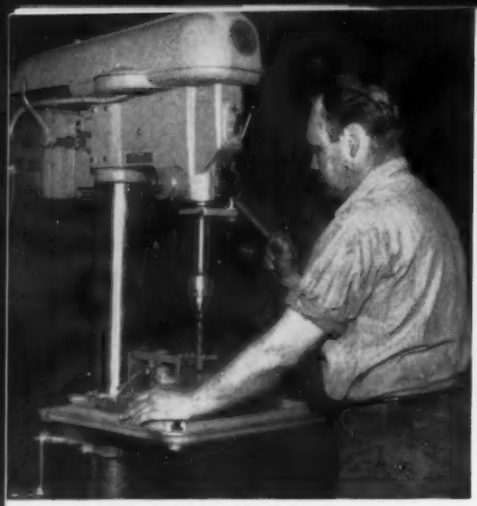
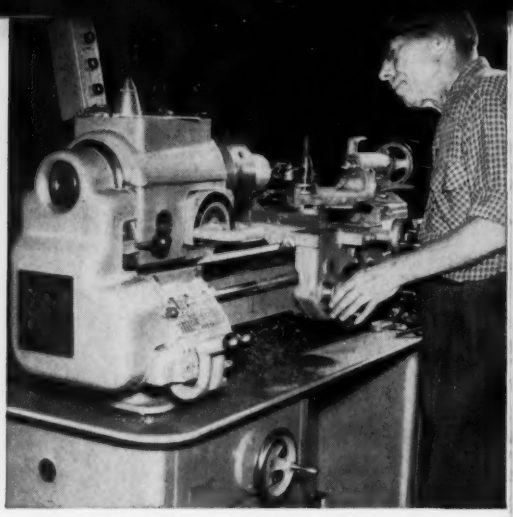


20" Drill Presses, 28 Models

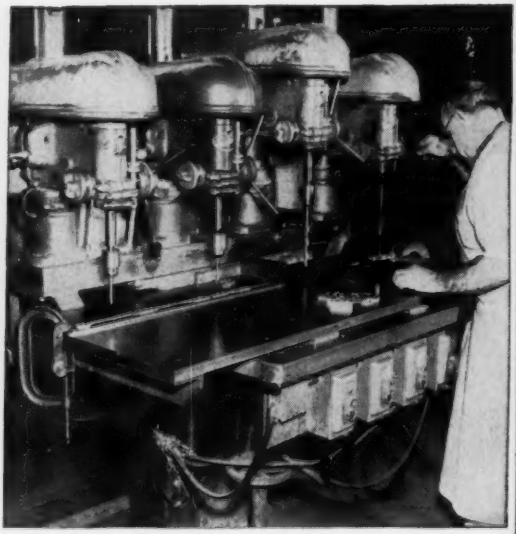


11" Metal Lathes, also 10" (4' and 5' Bed)

ON ANY SIZE JOB

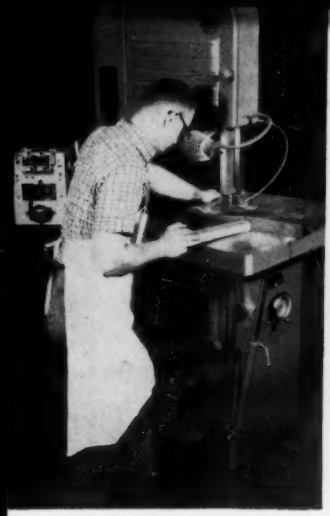
DELTA INDUSTRIAL TOOLS

Cut-off Machines, Wet & Dry Abrasive, Non-Ferrous and Wood



17" Drill Presses, 76 Models

For more data circle 320 on Postpaid Card

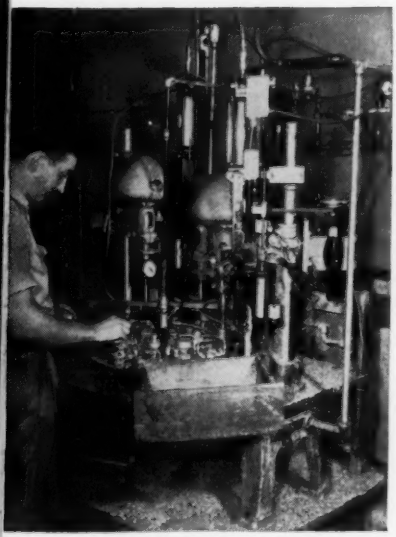


20" Band Saws, also 14"

Toolmaker® Grinders, also 6" and 7"

Hand Screw Machines

PAY THEIR OWN WAY



14" Drill Presses, also 14" Super-Hi Sensitive and 15"

You'll save money three ways when you put Delta Tools to work in your shop: they cost less to buy, less to operate, and less to maintain. They're ruggedly built to withstand hard wear, yet are completely mobile—offer you precision to meet the most exacting requirements.

And versatile Delta Tools can be "teamed-up" with standard automatic control devices to provide really "lo-cost" automation. Now *any* size plant can have the benefits of automation at a *fraction* of the usual investment.

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See Delta Industrial Tools at your nearest Delta Dealer . . . he's listed under "TOOLS" in the Yellow Pages.

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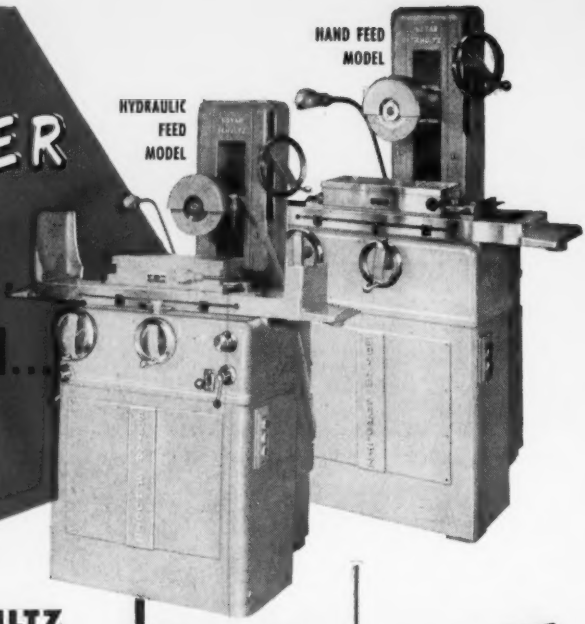
GREATER
PRECISION...
PRODUCTION...
ECONOMY...
with

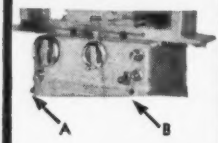


BOYAR-SCHULTZ 6x18 SURFACE GRINDERS

Available in Hydraulic and Hand Feed models.

These machine tools are of the most advance design, fully proved and enthusiastically endorsed by users who must have accuracy as well as production performance.

Exclusive features include heavy duty precision spindle; vertical column assembly supported by horizontal cylindrical ways; closely grained nickel alloy table with longitudinal ways of hardened and ground tool steel; vertical feed assembly with precision ground worm gear perfectly fitted to bronze gear for easy operation.



Hydraulic operation is accomplished by controls A and B above. These controls automatically disengage longitudinal and cross feed hand wheels.

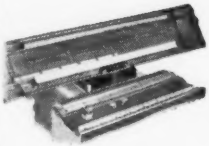


Table ways, one V and one flat are ground and hand scraped. They travel on hardened and ground tool steel ways.

Precision screw on vertical feed assembly turns through a perfectly fitted steel worm and bronze gear, operating in grease packed, sealed gear box.

Unique column assembly combines vertical and cross feed travel. Sturdy vertical column has oversize bearing surfaces. Hardened and ground cylindrical ways provide accurate long wearing surface for cross feed travel.

Write, wire or call. We'll be glad to SHOW you what this fine grinder will do.

BOYAR-SCHULTZ CORPORATION 2020 So. 25th Ave. Broadview, Ill.

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UNBELIEVABLE VALUES!...

IMPERIAL PRECISION LATHES

FROM 12" SWING TO 100" SWING
30" CENTERS UP TO 300" CENTERS

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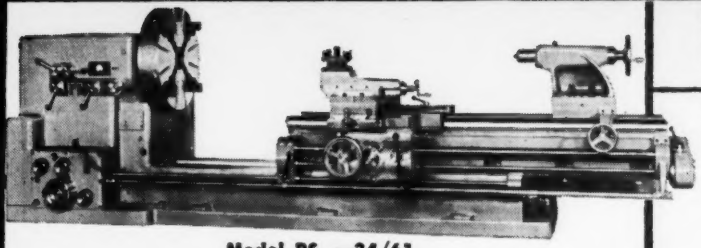
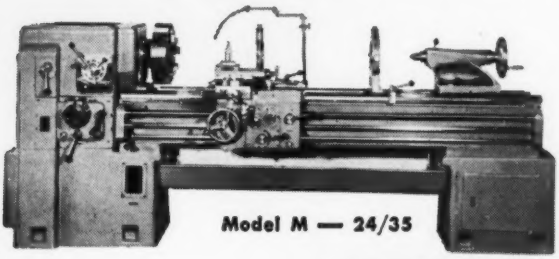


Model PS —34/61



Model M — 24/35

Flame hardened, ground bed ways.
Heat-hardened gears throughout.
Precision roller spindle bearings.

Sizes in inches	Basic Price
12x40	$ 1393.
14x40	$ 1593.
16x40	$ 2084.
18x40	$ 3447.
20x40	$ 3647.
24x40	$ 8220.
31x40	$ 9790.
34/62 sliding bed x 60	$13790.
34x60	$11180.
45x57	$16980.
67x57	$21280.

Extra large holes through the spindles up to 13½"

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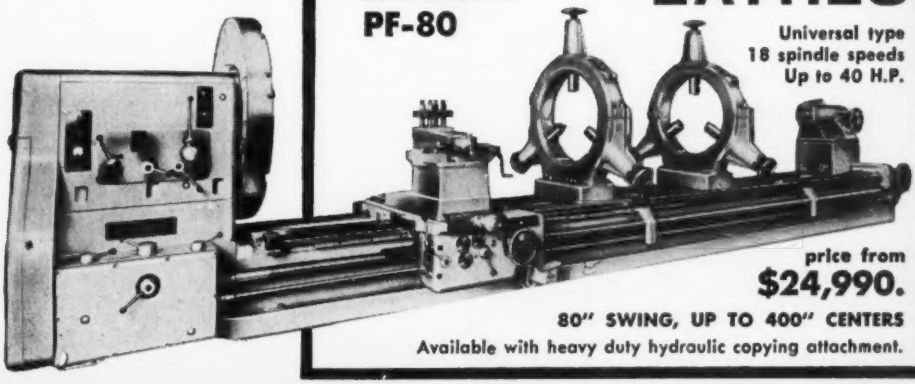
MISSILE LATHES

IMPERIAL PF-80

Universal type
18 spindle speeds
Up to 40 H.P.



price from
$24,990.

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Available with heavy duty hydraulic copying attachment.

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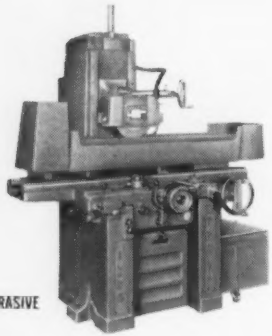
See other ad Page 24

the *ABRASIVE* line

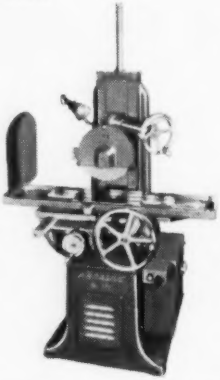
of precision surface grinders

first for accuracy... first for value



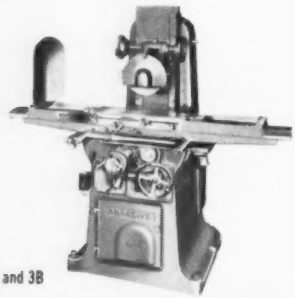
HYDRABRASIVE

The modern line of hydraulically operated surface grinders for general machine shops, production operations and tool shops. Four sizes with 12" wheel and 3 hp motor.



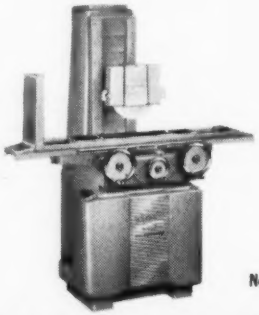
No. 1½

This is probably the most popular machine for tool and die work. Hand operated with a 12" wheel for deep slot grinding, 1 hp motor and 10" x 15" x 12" size.



No. M3 and 3B

For production and toolroom jobs where a fast, accurate surface grinder is needed with power table traverse and cross feed. M3 has 2 hp motorized spindle. 3B has 3 hp main drive with belt to spindle. Both 8" x 24" x 12" capacity with 10" wheel.



No. 618

One of the newest and most modern machines of its size for easy hand operation and dependable precision results. It's available with either a 7" wheel and 1 hp motor, or a 12" wheel with 2 hp motor.

ABRASIVE
precision surface grinders

a product of
LANDIS TOOL
world's largest manufacturer of
precision grinding machinery
WAYNESBORO, PENNSYLVANIA

COMPARE!

R-O RELIEF
Set-up time 5 minutes. Grinding time 9 minutes.

ANGULAR RELIEF
Set-up time 10 minutes. Grinding time 14 minutes.

The savings on set-up and grinding time for one tool when done on the R-O may appear insignificant—but extend it for a volume run—multiply it by days—then add these other R-O advantages: (1) More cuts per grind (2) More grinds per tool (3) Better, cleaner cuts (4) Elimination of operations (5) Reduced inspection (6) Reduced scrap.

Compare R-O's many advantages over conventional sharpening methods—Then get the R-O story. Send the coupon.

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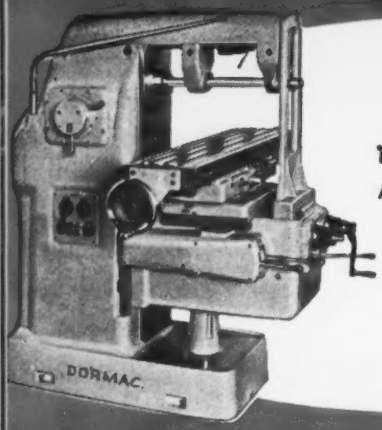


DORMAC • MILL-MATIC

DIAL TYPE • HIGH SPEED

1200 rpm Universal Milling Machines

ACCURATE • DURABLE • EASY TO OPERATE

National standard taper Power feed in all directions. Hardened and ground gears. Power rapid traverse.

MILL-MATIC 48" x 11" Table

DORMAC 60" x 12" Table

Standard equipment included.

WOTAN

HIGH PRECISION

3 3/8" BORING MILL

for Toolroom and Production

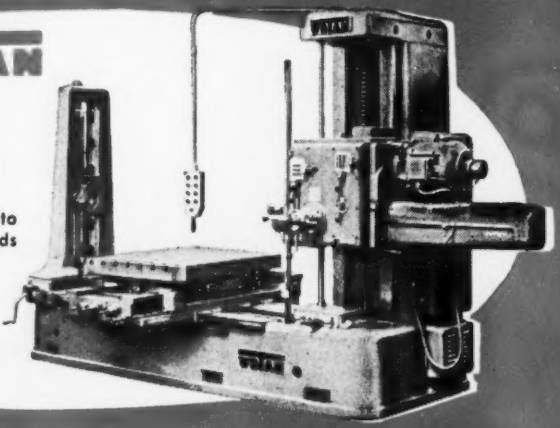
CAPACITY:

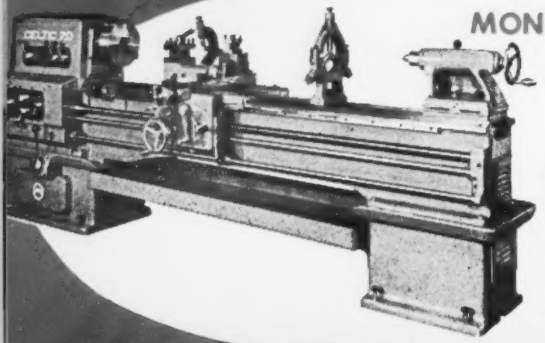
Vertical Capacity 36", Distance Spindle to Outboard Support 86", M.T. #5, Speeds up to 1000 RPM.

OTHER SIZES ARE BUILT IN:

4 3/8" and 5 1/8"

Table & Floor Type Models





MONDIALE **CELTIC**

PRECISION LATHES

CELTIC 20" LATHE

MADE IN 12"-14"-17"-20" SWINGS

QUALITY • PRECISION

DEPENDABILITY

DEALER INQUIRIES INVITED

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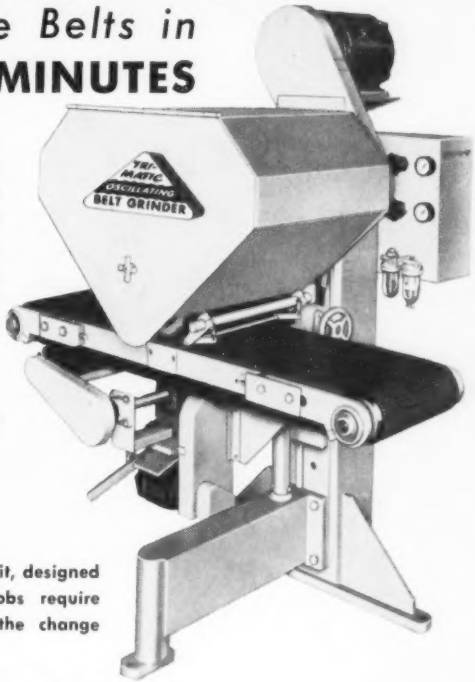
INDEX INDUSTRIAL CORPORATION

MM 660 MADISON AVE., • NEW YORK 21, N. Y. • TEmpleton 8-5161

NEW TRI-MATIC Oscillating Belt Grinder

deburrs, descales, grinds, polishes . . .
Change Abrasive Belts in
LESS THAN 2 MINUTES



BELT TRACKING adjustments are completely eliminated by the Aer-Tronically Controlled belt oscillation. There are no projecting belt guides to interfere with changing or to fray belt edges. Just slide one belt off and another on. It takes less than 2 minutes from turning off the machine to re-starting.

4 MACHINE SIZES IN 1

A simple adjustment of the air jet sensing unit permits use of 6", 8", 10" or 12" wide belts.

EASY CHANGE CONTACT WHEELS

The contact wheel and mount are one unit, designed for easy changing. Where different jobs require different contact wheel characteristics the change can be made in a matter of minutes.

Oscillating Belt Speeds Grinding, Prolong Belt Life

By imparting a shearing action, instead of a straight line push, the abrasive belt cuts faster, cleans itself better, reduces grinding pattern to a minimum and makes belts last longer. Variable speed conveyor adds to versatility.

Write TODAY for illustrated, descriptive Bulletin TM-459.

Send your deburring, descaling, grinding, polishing problems to our abrasive engineers for their suggestions. No obligation.

TRI-MATIC DIVISION

Sales Service Mfg. Co.

2361 UNIVERSITY AVENUE, ST. PAUL 14A, MINNESOTA

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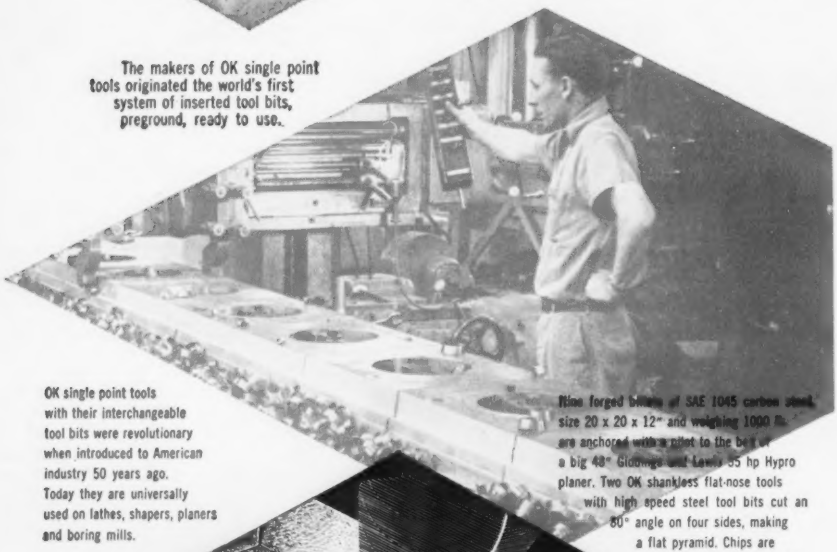
How Bullard with two **OK** Man-au-trol turret heads are gang-planed

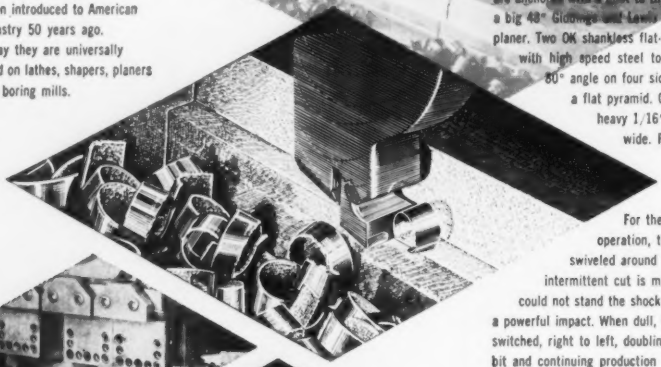
single point tools

The makers of OK single point tools originated the world's first system of inserted tool bits, preground, ready to use.



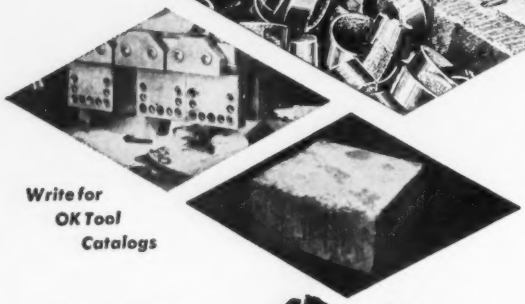
OK single point tools with their interchangeable tool bits were revolutionary when introduced to American industry 50 years ago. Today they are universally used on lathes, shapers, planers and boring mills.

Nine forged billets of SAE 1045 carbon steel, size 20 x 20 x 12" and weighing 1000 lb. are anchored with a pilot to the bed of a big 48" Gidding and Lewis 55 hp Hypro planer. Two OK shankless flat-nose tools with high speed steel tool bits cut an 80° angle on four sides, making a flat pyramid. Chips are heavy 1/16" depth, 3/4" wide. Feed, 40 ft/m.



For the second operation, the blocks are swiveled around and a rugged intermittent cut is made. Carbide could not stand the shock of such a powerful impact. When dull, tool bits are switched, right to left, doubling to life of the bit and continuing production with the minimum of downtime.

OK tools are built for heavy machining. Holders are tough forgings. For tool bits, you have a choice of high speed steel, cobalt, Vasco Supreme and carbide.



Write for OK Tool Catalogs

TWO COMPONENTS— BODY AND BLADES

OK modern milling cutters for modern milling machines

THE OK TOOL CO., INC., Milford, New Hampshire

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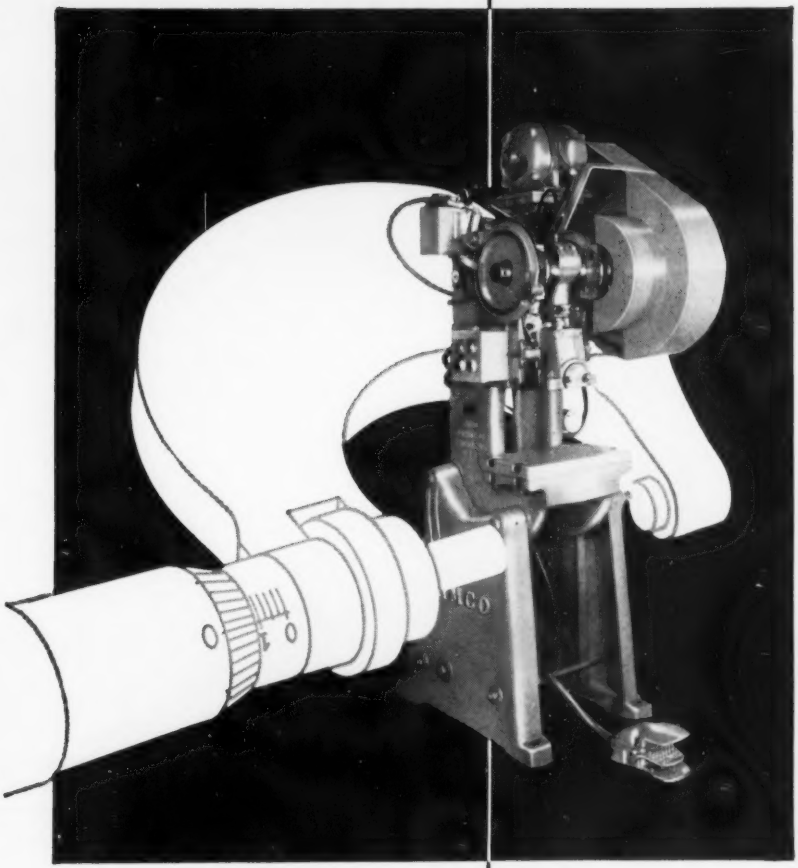

Only Famco Power Presses

offer you such a wide selection.

With over 50 models ranging from 5 to 18 ton capacity and 5 different clutch types, you are assured of having the right press for the job. Less maintenance, more value, too.

How to Figure Press Tonnage. It's in the Famco Press Catalog! May we send yours today?

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Manufacturers of: Milling Machines, Presses • Air, Arbor, Power, Foot • Squaring Shears, Band Saws.

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PRECISION & QUALITY

NEW MACHINERY

LIBERAL TERMS

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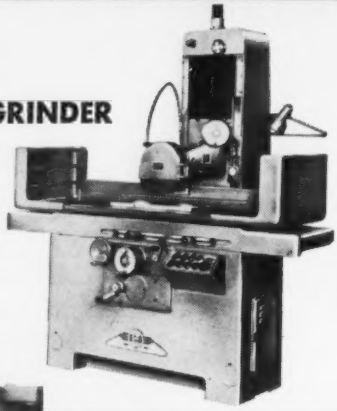

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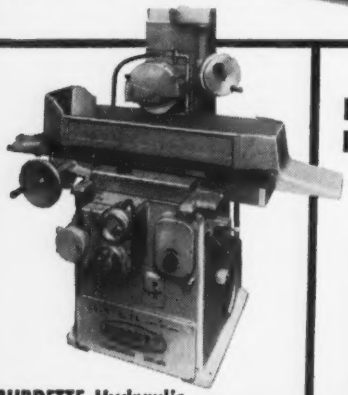
SURFACE GRINDER

High Output with High Precision Direct Drive Spindle Grinding Capacity from 10" x 18" up to 54" x 236"

price from **$3730.**

EAGLE HORIZONTAL SURFACE GRINDER **$795.**

Incomparable Price!
Grinding Capacity:
6" x 18" — 8" x 24"
High accuracy & Precision.

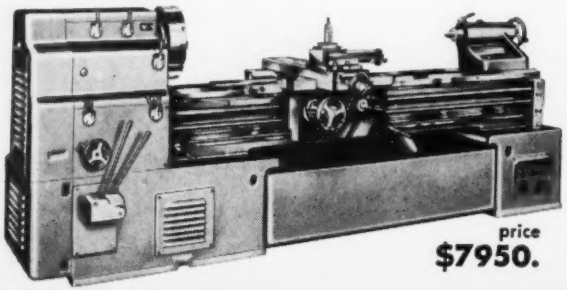


BURDETTE Hydraulic Horizontal SURFACE GRINDER
6" x 18" and 8" x 24" price from **$2975.**

AGENTS WANTED

IMPERIAL H D
HEAVY DUTY LATHE 16" — 20" — 24" SWING

Modern, high precision Lathe, elevated output, chip pan in single piece, 2 legs. Up to 25 H.P.



price **$7950.**

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tailor-make wrenches on the job...

with WILLIAMS SUPERSOCKETS®

You can tailor-make wrenches for any job ... big or small ... hand or power ... in a matter of seconds. From tiny assemblies to massive structural work, Williams broad line of Supersockets®, Power Drive Sockets and Superector® Wrenches covers the full range of openings from 3/16" to 4-5/8" for hex and square nuts.

Buy Williams BETTER TOOLS FOR BETTER WORK from Catalog 303

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DROP FORGED
TOOLS OF INDUSTRY

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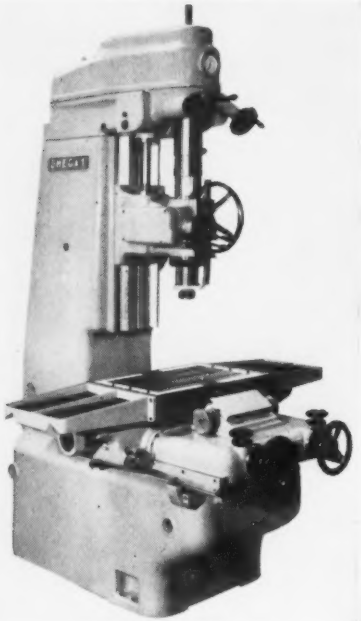
TWO NEW OPTICAL JIG BORERS

$8900.00



OMEGA NO. 1

- 20" x 32" TABLE
- 16" x 26" TABLE TRAVEL
- 25" UNDER SPINDLE
- 16 SPINDLE SPEEDS
- OPTICAL MEASURING
- DOUBLE VEE WAYS
- POWER HEAD ELEVATION
- 5000 POUNDS (Approx.)

Dealers Inquiries Invited

AMITOOL COMPANY, INC.

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EDGEWOOD 3-3400

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- 16" x 24" TABLE
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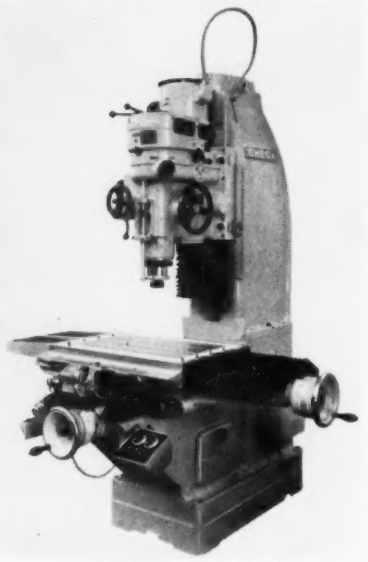
- BUILT IN OPTICS
- VARIABLE SPEEDS
- KWIK-SWITCH TOOLING
- 3965 POUNDS

CHECK THE

CAPACITY

OF THESE TWO
FINE MACHINES

$12,600.00



OMEGA NO. 2

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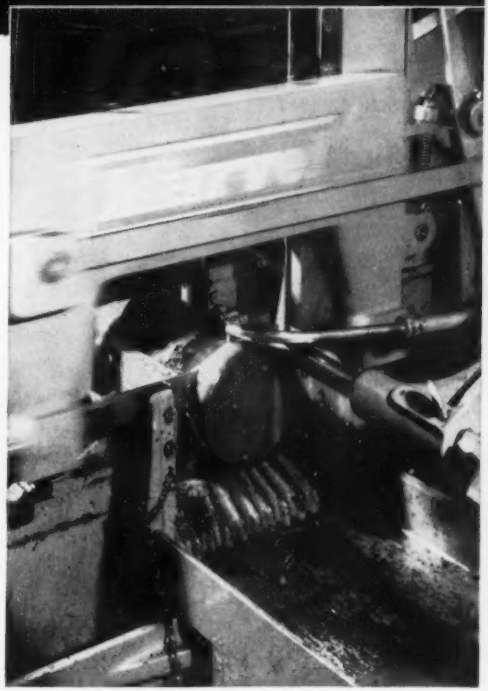
5 Basic Reasons why MARVEL HACK SAWS CUT-OFF MORE ACCURATELY...

The consistently accurate performance of MARVEL Heavy Duty Hack Saws is no accident. MARVEL engineers knew, many years ago, that to produce and maintain accurate cutting-off, a hack saw must be designed and built like a fine machine tool.

Some of the basic design principles built into the modern MARVEL Hack Sawing System that makes it the most accurate cutting-off method you can use are:



1. V-Way Design...Greater Rigidity

Upright and Saddle are precision machined and fitted to form a rigid, integral unit capable of withstanding any cutting load with no deflection or side movement.

2. Anti-Friction Bearing Construction

Anti-friction ball or roller bearings are used at all load carrying points. Even the strongly braced saw frame reciprocates on heavy duty, fully enclosed preloaded ball bearings which provide permanent, frictionless rigidity and true-running, straight line cutting strokes.

3. Minimum Blade Frame Reach

Close-coupled design and crank lever action of MARVEL Saws keeps the saw frame and blade reach very short in relation to the vertical V-ways on which the unit is mounted. This insures optimum rigidity, even under the most severe operating conditions.

4. Positive Relief Blade Lift

On the return stroke, positive relief lift raises the blade to provide proper and "cushioned" lead-in on the next cutting stroke. This prolongs blade sharpness, life and accuracy.

5. Rigid Cutting Tool

Cutting-off accuracy requires a rigidly held, relatively short cutting tool. MARVEL Unbreakable High-Speed-Edge Hack Saw Blades, which combine a narrow high speed steel cutting edge permanently welded to a tough alloy steel body, can be tensioned from 200% to 300% more taut than ordinary blades. This provides a most rigid cutting edge.

Catalog C85 has complete details, facts and figures on both Marvel metal cutting Hack Saws and Band Saws. Write for it today.

PS-1305

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

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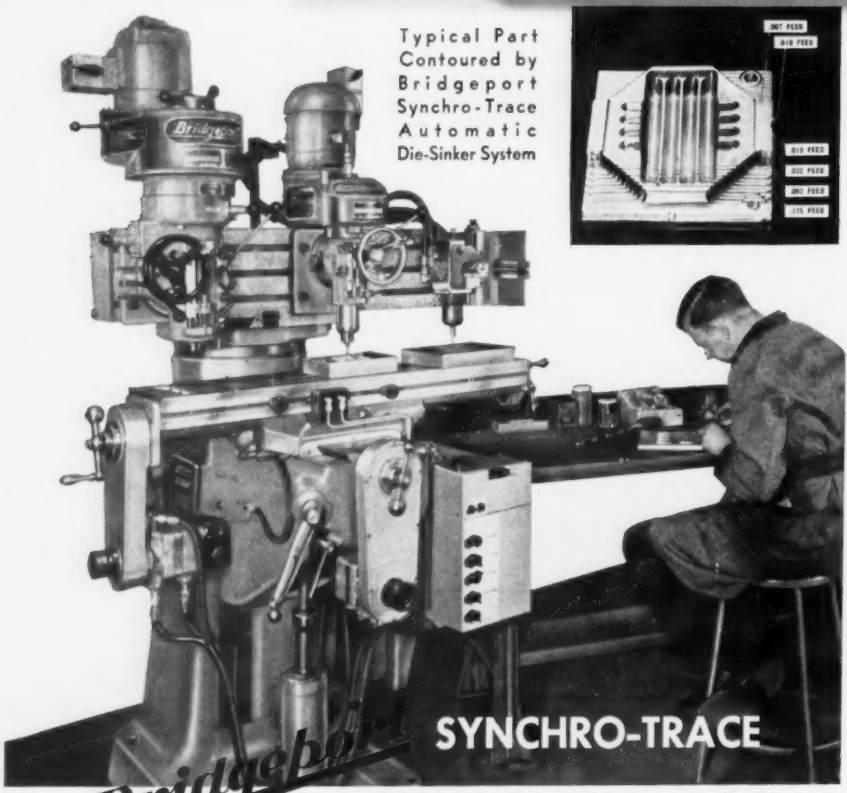


Typical Part Contoured by Bridgeport Synchro-Trace Automatic Die-Sinker System

Bridgeport SYNCHRO-TRACE produces accurately-controlled duplicated parts in far less time

In many cases parts are duplicated in 50% less time . . . at vastly less cost. Other advantages of the BRIDGEPORT Synchro-Trace include:

. . . since Synchro-Trace is similar to numerical control in that it follows a programmed cutting path and takes a pre-determined cut with every pass of the cutter, an accurate estimate of machining time required for die or part may be made. Estimating accuracy is further increased since the BRIDGEPORT Synchro-Trace operates continuously, without stopping, until part is complete.

. . . any type finish available by simple adjustment of pick feed.

. . . built-in power feeds on cross and longitudinal movements with variable feed rate.

. . . BRIDGEPORT Synchro-Trace provides push button rapid traverse.

. . . ability to use as a standard hand-fed machine.

. . . conventional 180° die-sinking available for rougning.

. . . uniform cutting feed in any plane, vertical or horizontal, saving tool costs and assuring greater accuracy because cutter neither overcuts nor undercuts on vertical walls. Uniform load on cutter extends tool life.

. . . ability to pick in either direction eliminates many hours of benching time. Hand or other finishing operations reduced to an absolute minimum, with costs reduced accordingly.

. . . all machining functions automatically stop when automatic shut-down knob is engaged and cutter has finished its last scanning pass.

Get further details by contacting your nearest dealer or us direct.

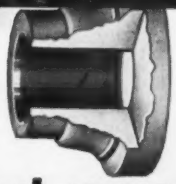
Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

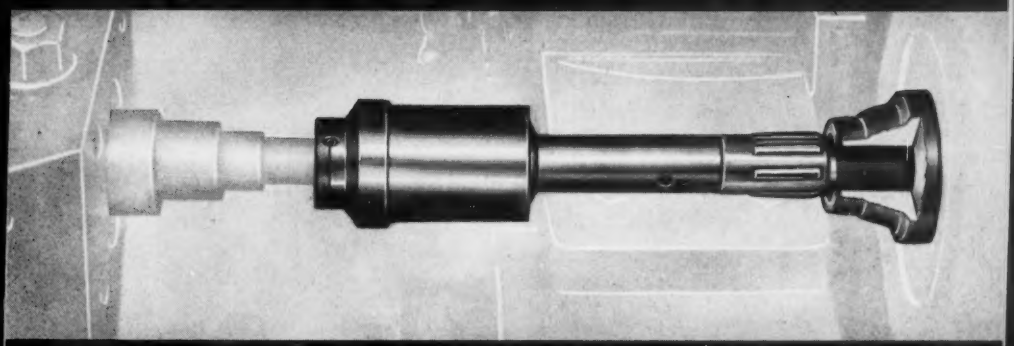
For more data circle 333 on Postpaid Card

from 125 to 5 micro-inches



surface finish

in one 5-second pass!



with the revolutionary **microller®** *burnishing tool*

- Finishes roughest bored or turned surfaces (ie: 200 mu-in. and higher) to finishes of 4 micro inches and lower.
- Finishes in one pass at feed rates of 8 to 12 inches per minute. A one inch length in 5 seconds!
- Finishes all machineable metals . . . all types of surfaces; internal and external cylindrical . . . tapered, radial, flat.
- Use tool in any machine . . . on any drill press, engine or turret lathe as a secondary operation . . . or right on the screw machine or automatic where other operations are performed! No special equipment needed.

ADJUSTABLE FOR SIZE CONTROL

- Sizes in increments of .000025" or less . . . performs sizing operations never before possible. Invaluable for sizing bearing seats, oilite bushings, parts out of tolerance, etc.
- Run thousands of parts without tool wear. No stones to replace. Highly hardened rolls and tip last for thousands of parts. Tool maintains size setting . . . no adjustment necessary. Wearing parts replaceable. Simplest setup and operation . . . no skill required.
- Stock shipment in popular sizes. Tools and replacement parts available from stock for off-the-shelf delivery.
- Refined, improved surface, a new concept. Tool marks and surface imperfections are rolled out. Grain structure is condensed and compacted . . . workhardened and refined; fatigue properties are improved. An ideal, wear-resistant, surface results . . . free of damaging abrasive grit inherent in honing or grinding.
- The top twenty companies in the metal working field . . . plus more than a thousand others have replaced costly finishing and sizing methods with the Microller burnishing tool. In actual case histories, finishing costs have been cut by 90% . . . production rates increased by eight and nine times.
- Results guaranteed: The Microller is backed by Madison-Faessler's 80 years of experience in producing cold rolling tools . . . and is sold on a results guaranteed basis. Sales and service representatives in all principal cities.

Write for further information

MADISON-FAESSLER TOOL CO.

Dept. MM10, P.O. Box 1137, Providence, R. I.

(Affiliated with Madison Industries)

For more data circle 334 on Postpaid Card

Announcing ... **in METAL REMOVAL**

NOW! for the FIRST time HYDRAULIC FEED on a 10" x 16" grinder

LOW COST
Micro-Precision, High Speed Grinding

No. 17H
Priced at only
$3285.00

to give you the operating ease and high speed of hydraulic feed for little more than the cost of a hand feed grinder.

For precision surface grinding on tool room or production jobs, you can't beat the Covel No. 17H. The large grinding wheel with plenty of direct power *plus* high speed hydraulic feed and big cross-feed capacity make it a real money saver. *Grinds approximately twice as fast as with a comparable hand feed machine.*

First with hard chrome table ways...
Preserve original accuracy of hand-scraped V and Flat tableways. Available at extra cost on all Covel Surface Grinders.

Micro-Precision a Covel Tradition-Since 1874

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write, wire or call us TODAY We'll gladly show you what the Covel 17H can do for you. Ask for Bulletin M-109.

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Announcing...

THE ULTIMATE IN METAL REMOVAL

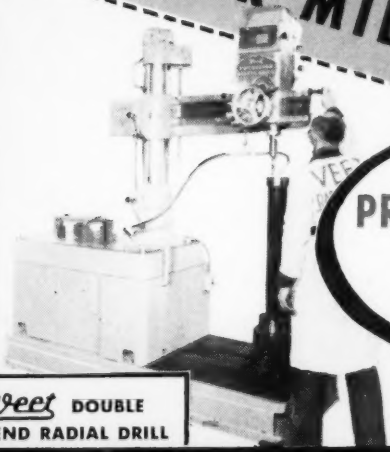
Veet High Pro '30'

"SPEED MILLER"

FOR PLANER MILLING

- **30 HORSEPOWER**
- **QUILL FEED**
  (Motor Is Stationary)
- **MULTI-SPEED**
  (For All Metals)
- **INDEXABLE CARBIDE BLADES**

CONVERT Your PLANER To A HIGH HORSEPOWER PLANER-MILL



INCREASE PRODUCTION 1500% AND MORE OVER PLANING

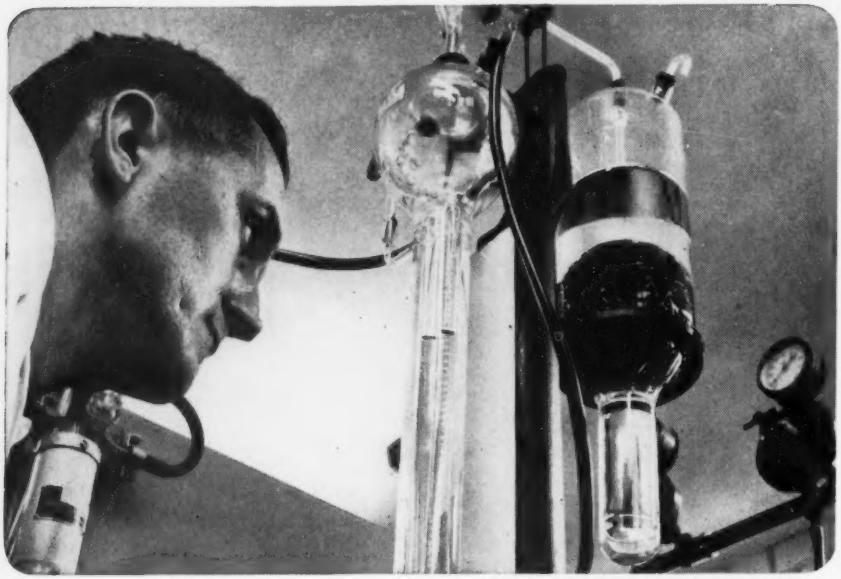
Veet DOUBLE END RADIAL DRILL

Complete Conversions or Equipment Package

Veet INDUSTRIES

TEL. PRescott 6-3000
EAST DETROIT, MICH.

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



QUICK, FAST TESTING for carbon content is done not once or twice but 8 times per melt in A-L's Chem Lab with this direct reading Leco carbon determinator.

Carbon content checked 8 times during melt to guarantee A-L tool steel hardenability

Lab tests for carbon eliminate your guesswork; provide high hardness, uniform hardenability, reproducible tool performance.

Because carbon has the greatest influence on hardenability, Allegheny Ludlum watches it carefully during the melt. Testing a specimen for carbon takes only a few minutes. Therefore, A-L checks for carbon content 8 times during the melt, and makes the necessary adjustments to insure accurate control of carbon. This control means Allegheny Ludlum can hold carbon content to a closer range than most customers specify.

Carbon control at Allegheny Ludlum assures you of precise response to heat treating. This control in the melt brings you predictable, *high hardness, uniform hardenability* and *reproducible tool performance.*

This is just one of the many things A-L does to insure high quality. Here are some others: close control over forging techniques, rigid temperature-time programming, careful testing of billets prior to processing to insure good surface and sound interior, control over annealing to give you the right hardness for your exact machining operation, thorough metallurgical testing to insure top tool steel quality and meeting of your specifications.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. MS-22

WSW-7201

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

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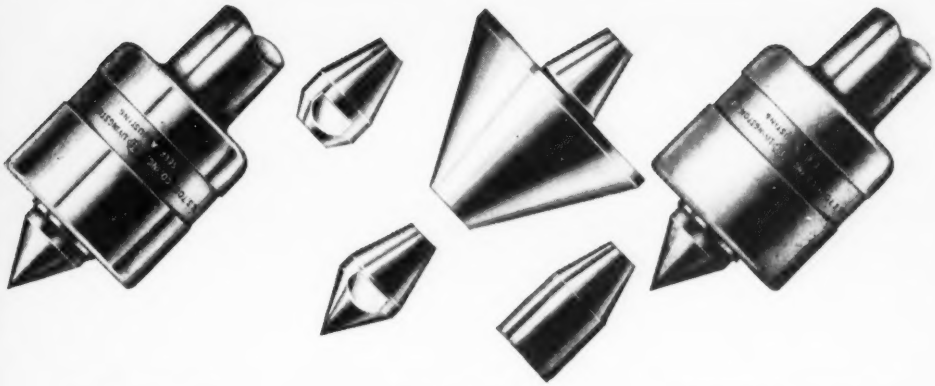

Famous Perfection
Grinding Live Center

H.S.S. and Carbide
Accurate Detachable Points

Expansion Compensating
Lathe Centers

ANNOUNCING THE FIRST COMPLETE LINE OF PRECISION-BUILT LIVE CENTERS

INCLUDING 5 TYPES OF . . . . .
EXPANSION COMPENSATING CENTERS

- **the only complete line**
- **the only guaranteed self-adjusting live center**

INTRODUCING J & S Tool Company's complete new line of live centers with accuracy better than .0001", with these features:

- Guaranteed one year.
- Self-adjusting bearing take-up.
- RPM speeds up to capacity of present-day machines.
- Correct capacity rating.
- Hardened and ground throughout.

Write today for a free copy of the J & S Live Center Catalog.

J & S TOOL CO., INC.

871 Dorsa Avenue

LIVINGSTON, NEW JERSEY

J & S TOOL CO., INC., ALSO MANUFACTURES FLUIDMOTION WHEEL DRESSERS CLAMPS • NO-BEND MILLING ARBORS AND CLAMPCUT MILLING VISES

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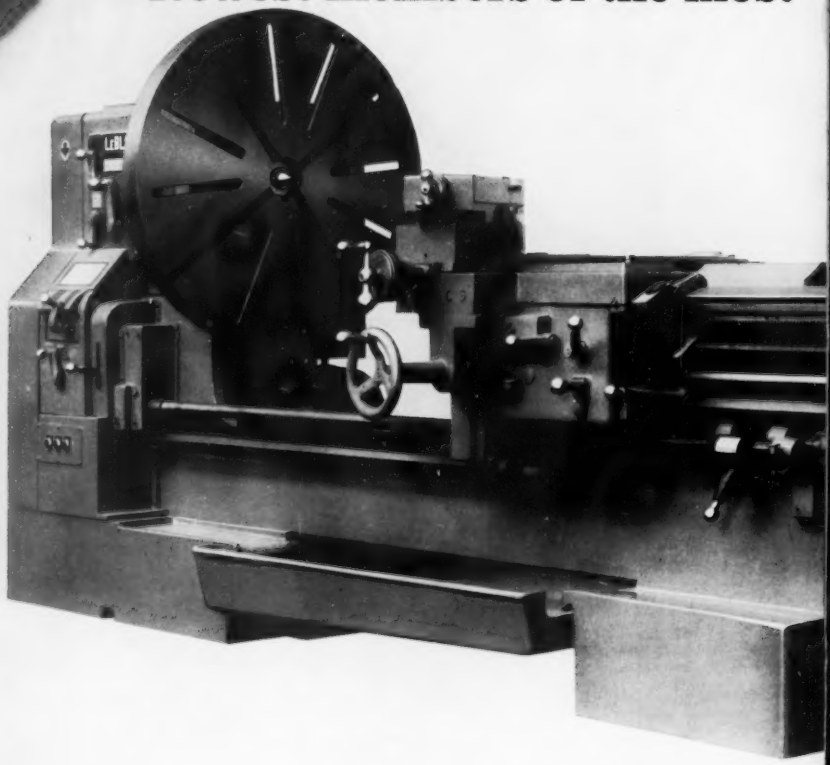
Newest members of the most



	REGALS		NEW!		HEAVY DUTIES		
	17"/28"	19"/28"	21"/39"	24"/39"	16"/38"	25"/50"	32"/60"
Swing over bed and carriage wings	17¾"	19¼"	22¼"	26"	20½"	30½"	34½"
Swing over gap	35"	36½"	48½"	52½"	46"	56"	61½"
Distance between centers, base, gap closed	30"	30"	48"	48"	72"	96"	84"
Distance between centers, base, gap open	50"	50"	84"	84"	120"	156"	144"
Horsepower, max.	5	5	10	10	20	50	60

Hollow Spindle Head available on all but 17" and 19" models.

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versatile family in the world

21" and 24"/39" Regal

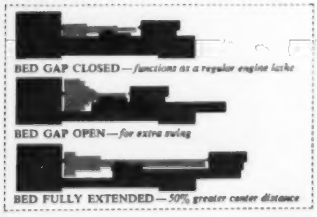
SLIDING BED GAP LATHES

Turning department in one machine!

The LeBlond Sliding Bed Gap Lathe is the most versatile turning machine ever built. With the bed closed it functions as a regular engine lathe. Its special bed *slides* open to form a gap of the proper opening to accept odd-shaped parts and large diameter jobs. Sliding the bed open also provides greater distance between centers. In addition, you get all the outstanding features, the stamina and dependability you expect in a LeBlond Lathe.

The two new members bring the family up to seven! Select the one that suits you best from the chart at left.

Call your LeBlond Distributor or write-


BED GAP CLOSED—functions as a regular engine lathe
BED GAP OPEN—for extra swing
BED FULLY EXTENDED—50% greater center distance

Here's how a LeBlond Sliding Bed Gap Lathe gives you extra capacity, versatility:

LEBLOND of Cincinnati

THE R. K. LeBLOND MACHINE TOOL COMPANY
CINCINNATI, OHIO

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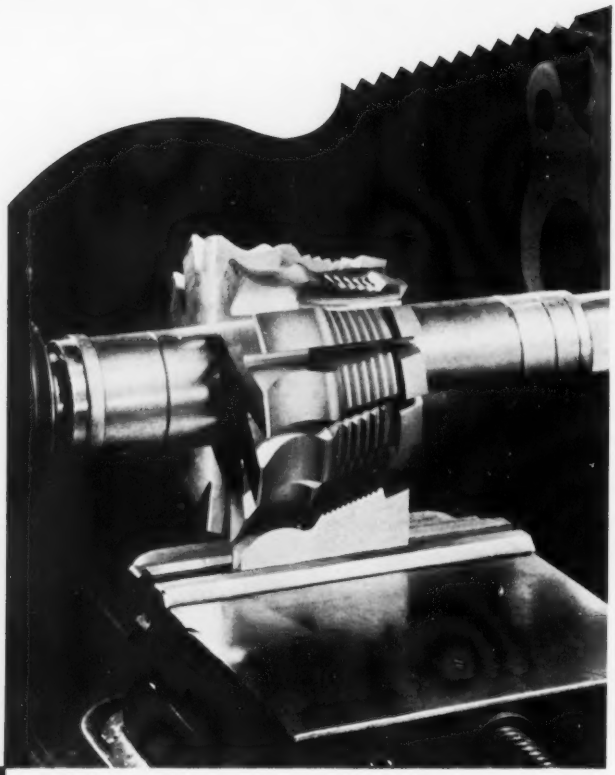


Cutters with built-in Efficiency and Accuracy

This is an example of how efficiency and accuracy can be designed right into the cutting tool. The manufacturing and engineering capabilities of Barber-Colman Company can be added to your own in finding better solutions to milling problems.

The form shown at the left of the part is milled at the same time the multiple serrations are cut. Milling sharp points on the serrations is made possible by the alternate tooth design (see photo, above). The cutter is shown milling a sample which is later projected against an enlarged layout of the part to assure that the cutter will produce within specified tolerances. But, some of the most important quality features of this cutter are not visible to the naked eye.

Unground form . . .

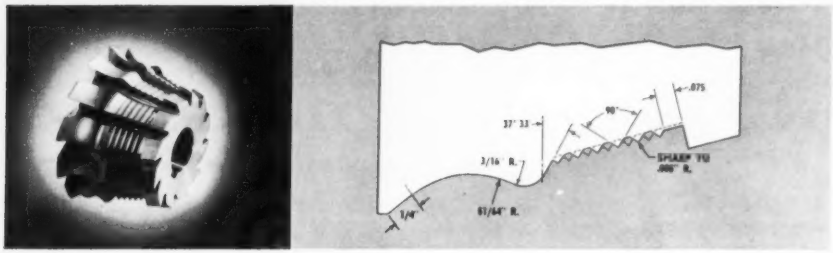
Ability to combine complex tool geometry and accuracy in this cutter without form grinding reduces original cost. In addition to greater accuracy, you get longer tool life from a cutter that is metallurgically as well as geometrically well formed. Barber-Colman's individual processing in the most modern metallurgical lab and heat-treating department assures highest quality which can be tested by the number of high-quality parts manufactured for every dollar of cost.

Sharpening economies . . .

Additional savings result from Barber-Colman's exclusive design and manufacturing techniques. For example,

Mill Odd Shapes in One Operation

...with Barber-Colman Form-Relieved Cutters



the smooth finish on the tops and sides of the teeth eliminates rough edges — a common cause of breakdown on the flanks. Faces are index-sharpened, permitting the important economy of *automatic resharpening*. Your sharpening guide or an automatic sharpener will maintain original accuracy throughout the life of the cutter.

These economies reduce the most important elements of tool cost: the cost of scrap and rework, cost of sharpening, cost of downtime for tool changes, and cost of tool depreciation.

Five types of engineering...

You get more than a cutting tool when you buy "Barber-Colman." You get five types of specialized engineering that reduce your costs and upgrade your quality:

1. *Application engineering* — on-the-spot evaluation of milling problems by experienced tool designers.
2. *Design engineering* — highly specialized tool engineering, backed by electronic computer facilities for fast, accurate calculation of complex forms.
3. *Metallurgical engineering* — specially selected steels and heat treatment for your particular material and tool geometry.
4. *Manufacturing* — the most complete and advanced processes under one roof for producing exactly the right finish, highest accuracy, and *any* cutter style.
5. *Quality control* — optical master inspection, seven different control stations, and numerous separate inspections for individual cutters.

Whether you want to combine operations, change processes, or just get more out of your tooling dollar, you can have a Barber-Colman field engineer at your desk for consultation by just calling Rockford — TR 7-5741.

Barber-Colman Company

BARBER COLMAN

104 Loomis Street, Rockford, Illinois

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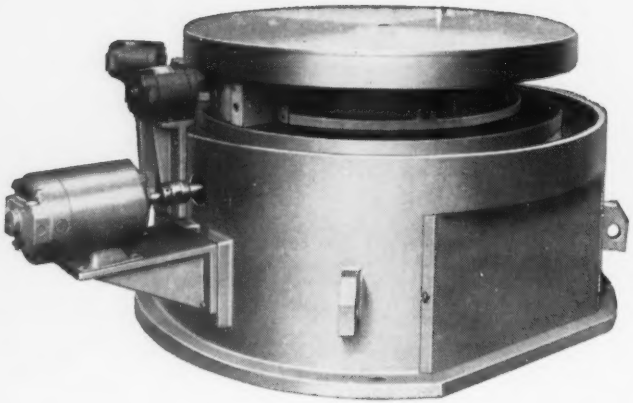

drill varied hole patterns without changing set-up

If your drilling, tapping, or milling jobs require even, uneven, or skip indexing, this new Electrodex table will give you more flexibility than ever.

Set up your work piece just once on this table, and you can drill many different hole patterns. Changeover from one index pattern to another is fast. You can do it mechanically—with index rings or inexpensive templates—or by push-button electrical counting.

Eight-channel numerical tape control is available. You get indexing accuracy to ±.001″ at a 45″ diameter. And you can choose your table size from 30″, 45″, 60″, and 80″ diameters.

Bulletin 258 gives complete details.

Avey Division, The Motch & Merryweather Machinery Co., Box No. 1264. Cincinnati 1, Ohio.

Avey

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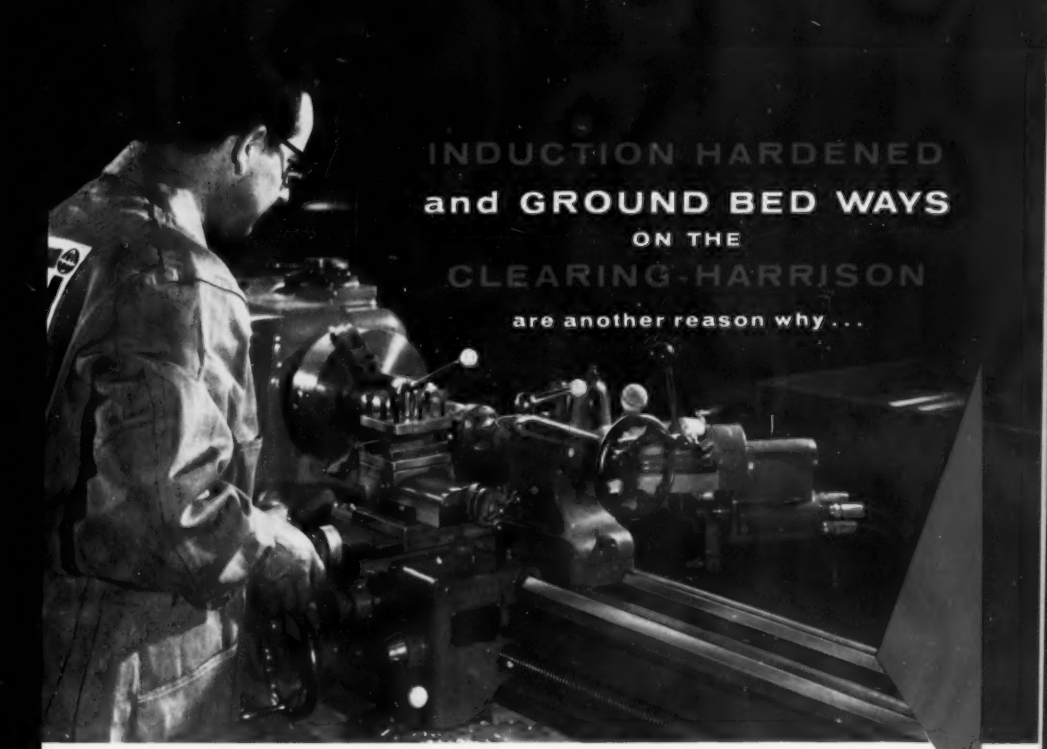


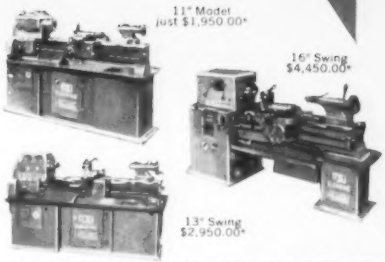
You get more . . . far more . . . for your money in a Clearing-Harrison Lathe

Users are amazed at the many plus features built into Clearing-Harrison lathes. The pure craftsmanship in this line of lathes can normally be found only in unusually expensive equipment. Yet the price of these lathes is low—a factor made possible only because we have the world's most modern equipment for producing lathes. For example, Delapina induction hardening and grinding equipment—the world's finest—is used to turn out precision, highest quality bed ways economically and quickly. These hardened ways mean longer life, less "down time", and lower maintenance.

And there's more! Taper roller bearings in the spindle; precision heat treated gears; and an all geared headstock.

Each lathe is available with or without a removable insert in the bed that increases the swing. For example, the 13" size increases to 20½".

Just check the prices at right. Then check the Clearing-Harrison line. You'll be surprised, too—pleasantly surprised. Write Clearing for the name of your nearest dealer.



*Base Price F.O.B. Chicago, Los Angeles and New York. Also available with factory-built copying attachments.

Coast to Coast Service Facilities

Clearing's nationwide facilities assure you of prompt service always. Replacement parts and accessories are stocked at Clearing and are available through all three plants, at all service centers and through all Clearing dealers.

USI Clearing

DIVISION OF U. S. INDUSTRIES, INC.

6499 W. 65th St. • Chicago 38, Illinois • Plants in: Chicago, Hamilton, Ohio, Los Angeles

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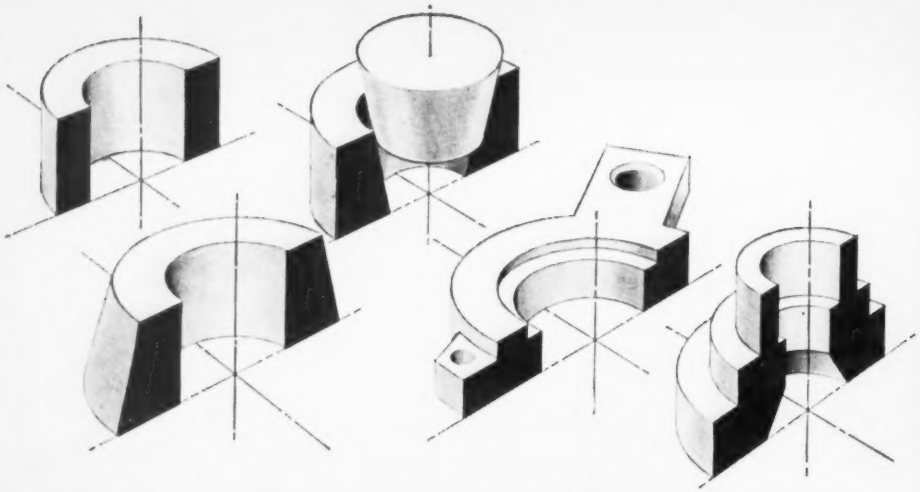


when to consider Vertical Grinding

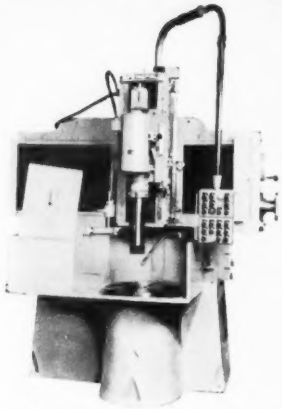
A simple test you can try for yourself quickly determines whether you should consider the Springfield principle of *vertical* grinding. Try it!

CHECK YOUR ANSWERS TO THIS QUIZ	YES	NO
1. Do you grind holes 4" in diameter and larger?	☐	☐
2. Do you grind taper holes or mating parts?	☐	☐
3. Do you grind on irregular shaped work?	☐	☐
4. Do you grind O.D. or I.D. shoulders, offsets, undercuts?	☐	☐
5. Do you grind pieces requiring extreme concentricity?	☐	☐
6. Do you require a 5 micro-inch or better finish?	☐	☐
7. Do some of your grinding jobs require many setups?	☐	☐

If you answer yes to three or more questions, a Springfield vertical universal grinder probably can save real time and money in your plant. Mail the coupon today for your free and informative copy of "Vertical Universal Grinders"; Bulletin 197-F.

THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO

SPRINGFIELD



Above is a standard Springfield 2A-TR vertical universal grinder. It swings 25"; the grinding head has a 21" stroke and it grinds holes to a nominal depth of 18". The head can be tilted 45° in either direction. Electro-hydraulic control is standard with pendant pushbuttons. The Model 2A-TR costs less than most horizontal chucking grinders of comparable size; it can do the same work plus a wide variety of jobs that just can't be done on a horizontal. Gravity works for you in vertical grinding.

For more data circle 343 on Postpaid Card

Job Facts:

Existing equipment: #2 Snow vertical drilling machine
Part: mounting base for power transistor
Material: electrolytic tough pitch copper
Threads: 10-32
Production: 1000 parts per hour

ONE *Acme-Fette Thread Rolling Head*

Thread Rolls 5,000,000 Pieces

without major investment

"A standard thread rolling machine would cost from seven to eight times more money than is invested in our Acme-Fette Thread Rolling Head *and* the existing equipment on which it is installed", says H. M. Oshry, Vice President of Steel Industries, Inc., Crawfordsville, Indiana.

The extremely rugged head achieved this outstanding production record with only three sets of thread rolls, producing threads with consistently closer tolerance and uniformity. A higher tensile strength is also obtained, and the resulting surface hardening provides a surface quality not achieved by any thread cutting method.

Acme-Fette Heads roll all parallel thread forms from 1/16" to 2" at speeds equal to turning speeds with high speed tools . . . up to 5 times faster than conventional thread cutting. For cost reducing ideas showing how you can put these heads to work on your *present* equipment, send for Bulletin NAF-57A.

National Acme

The National Acme Company
183 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

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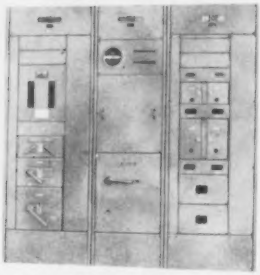
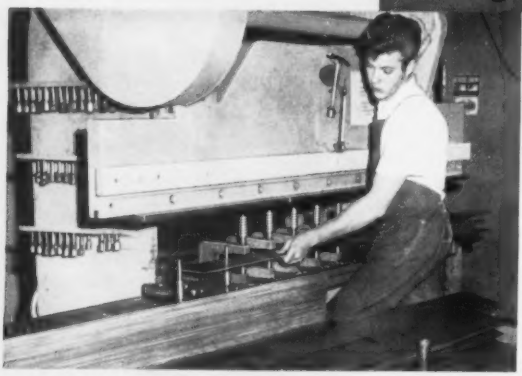
Built better by "BULLDOG"... using THE COST-CUTTING **STRIPPIT** SYSTEM



Power switchboard by BULLDOG ELECTRIC. Fully interchangeable parts.



PRESS SETUPS OFF THE SHELF!

BULLDOG ELECTRIC stores Strippit drilled templates on conveniently located shelves, Strippit Hole Punching Units and Tooling on this mobile rack. Pilot pins on units slip-fit into template pilot holes for exact positioning, quick mounting outside press by bench man. All units reusable over and over in unlimited patterns.

NO LOSS OF PRESS TIME!

Strippit setups cut between-run time to a minimum—just remove last set-up from press bed, insert new one and start run. Both short and long runs are profitable with Strippit setups. Here, parts for BULLDOG switchboards are being perforated accurately and rapidly. In other operations, Strippit Notching Units provide equal flexibility.

H. J. LOCKWOOD, Plant Superintendent, **BULLDOG ELECTRIC PRODUCTS** of Los Angeles writes:

"In building BULLDOG Switchboards to perfect uniformity for full interchangeability of parts, I have centered our production methods around Strippit tooling. All the perforating and notching operations are performed without fixed dies. Work flows smoothly through the machines without tieups. In no other way could we produce this quality product so efficiently."

WRITE TODAY for details on the savings you could be enjoying with Strippit setups on your presses!

WALES STRIPPIT INC.

200 Buell Road, Akron, New York

Manufactured in Canada by: Strippit Tool & Machine Company, Brampton, Ont.

HOUDAILLE INDUSTRIES, INC.

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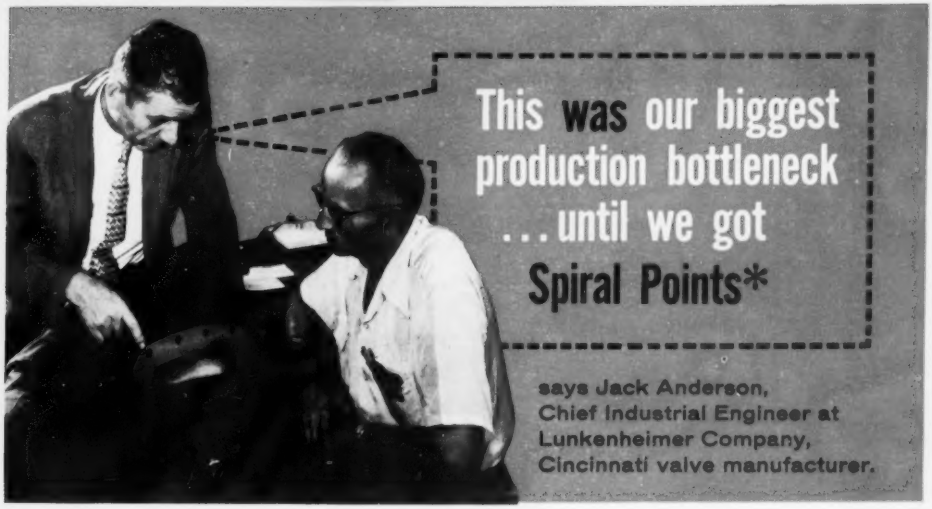


This was our biggest production bottleneck ... until we got Spiral Points*

says Jack Anderson, Chief Industrial Engineer at Lunkenheimer Company, Cincinnati valve manufacturer.

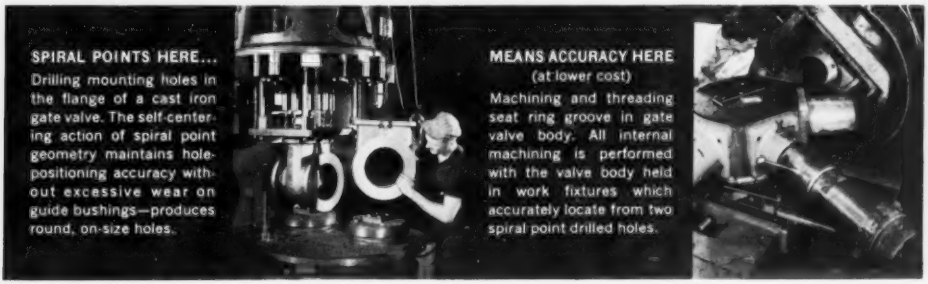
"Just two of these holes are critical—all other machining operations are located from them. But it used to cost us plenty to get them right—frequent drill resharpening, slower feeds, touching up the holes, even special locating pins and eccentric guide bushings.

"It sounds like a miracle, but our spiral point drills broke this production bottleneck completely! They maintained consistent hole size, well within our plus .005" minus .004" tolerance. They don't walk, so guide bushing wear has been practically eliminated. And, where we used to get 225 to 250 parts per drill grind, we now average 2000 or better.

"In short, they drill holes where we want them, to the size we want them . . . in one pass. Now production stays on schedule . . . scrap is negligible."

**Spiral point is Cincinnati's new drill point geometry which transforms a standard twist drill into a cost-reducing, precision tool. Cincinnati's SPIROPOINT® DRILL SHARPENER automatically applies this new point geometry in a matter of seconds.*

ASK YOUR CINCINNATI LATHE AND TOOL CO. DEALER, OR WRITE TO US DIRECT.


SPIRAL POINTS HERE...
Drilling mounting holes in the flange of a cast iron gate valve. The self-centering action of spiral point geometry maintains hole-positioning accuracy without excessive wear on guide bushings—produces round, on-size holes.
MEANS ACCURACY HERE
(at lower cost)
Machining and threading seat ring groove in gate valve body. All internal machining is performed with the valve body held in work fixtures which accurately locate from two spiral point drilled holes.

Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

For more data circle 346 on Postpaid Card

more ACCURATE • more CONVENIENT than any you've known!

THIS FEDERAL MIKEMASTER has an easily read Indicator instead of the barrel graduations usually found on micrometers: There's no need to interpret a vernier. Finest measurements are read directly from Dial's clearly calibrated scale graduated in .0001". Mikemaster always *gages with same pressure.* You can gage *fast* since there's no need of carefully applying correct gaging pressure. If it's *duplicate* parts you're measuring, you'll find the push button retracting anvil and tolerance hands particularly useful, permitting tool to be used as an Indicating Snap Gage.

Mikemaster is built to last, with sturdiness to spare, and the measuring surfaces are lapped tungsten carbide. Ask to see it . . . and try it on your work.

FEDERAL PRODUCTS CORPORATION

91410 Eddy Street • Providence, R. I.

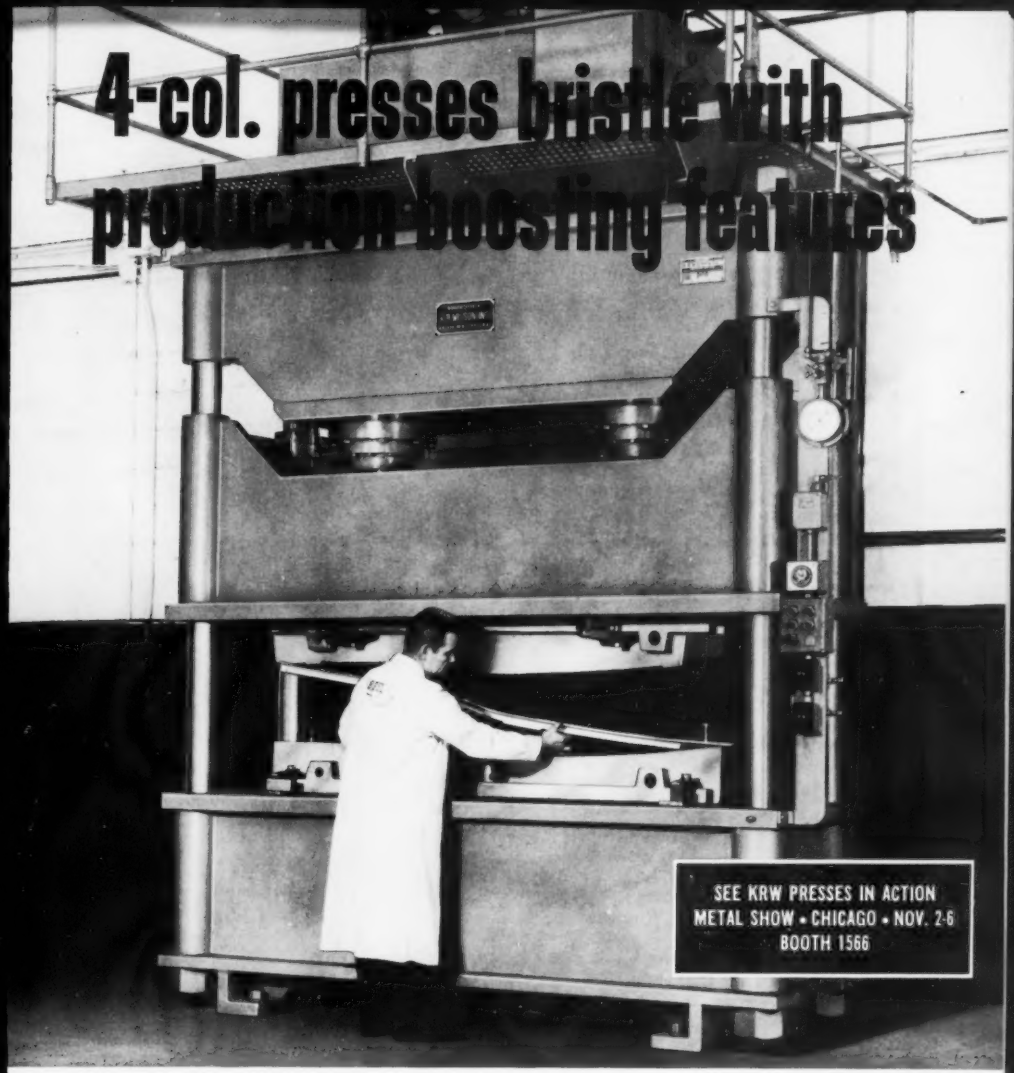
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

For more data circle 347 on Postpaid Card

4-col. presses bristle with production-boosting features



KRW has done it again! This time, the 25-1000 ton KRW line of 4-column, single action hydraulic presses has been modernized to set a new pace over a broad work range.

Bristling with newness, these smooth-acting machines are built to outperform even KRW's highly regarded, prior designs in a wide variety of assignments: Blanking, forming, punching, trimming, drawing, extruding, briquetting, straightening, pressure clamping, laminating and bonding.

Already acclaimed "a marked success," KRW's latest version of the 4-column press boasts numerous features to improve quality and increase productivity: Of rugged, welded steel construction, the crown, bed and sliding platen provide maximum resistance to deflection. Align-bored to automatically controlled tolerances, the sliding platen is guided on ground and polished columns which are closely fitted into the crown and bed.

Easy to adjust, KRW hydraulic systems assure instant, complete press control. Compactly designed, the pumping unit can be mounted at the top of the press or furnished for floor installation.

Available with either up-acting or down-acting platens, KRW 4-Column Presses can be outfitted with manual lever or electric push buttons for single or continuous cycling.

For detailed information and specifications, write for Bulletin 95-D. K. R. Wilson, Inc., 216 Main St., Arcade, N. Y.

KRW HYDRAULIC PRESSES

For more data circle 348 on Postpaid Card

NOW

"COLD-POINT" DRILLING!

of Super-Hard Metals, Glass or Ceramics with "Buffalo" Hollow Spindle Drill. Speeds to 10,000 RPM!

Now you can buy a production drilling machine especially designed to deliver the high speeds and forced coolant flow necessary with the new hollow core cold-point drill, and diamond impregnated bits.

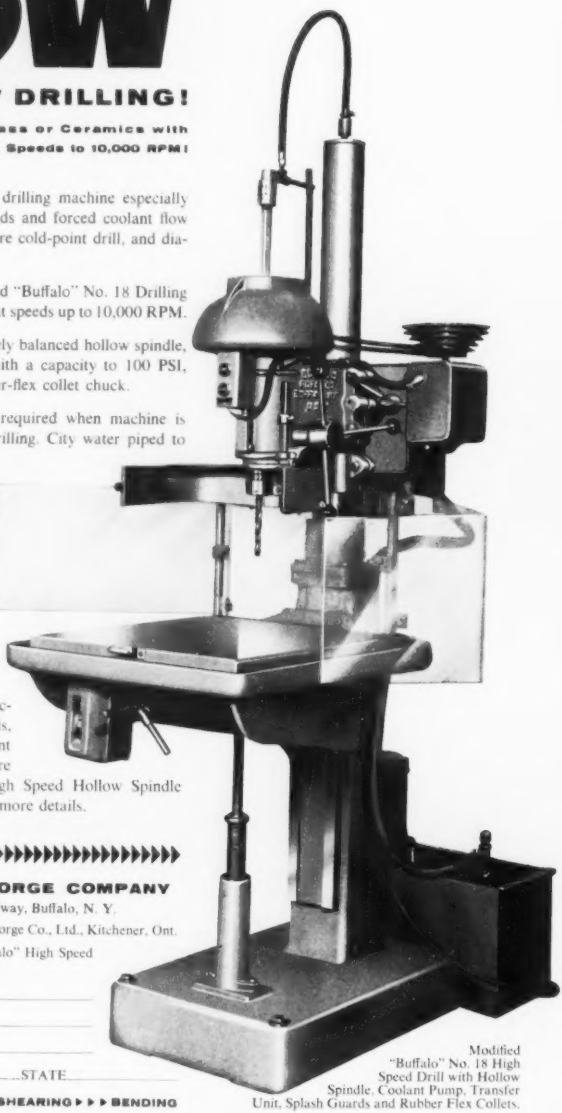
This modified version of the rugged "Buffalo" No. 18 Drilling Machine is successfully operating at speeds up to 10,000 RPM.

Modifications include: an accurately balanced hollow spindle, coolant system having a pump with a capacity to 100 PSI, special splash guards and a rubber-flex collet chuck.

The high pressure pump is not required when machine is used only for glass or ceramic drilling. City water piped to the spindle is all that is necessary.

It is possible to handle heretofore impossible drilling jobs at production speeds and regular drilling can be done much faster. In many cases reaming or finishing can be eliminated because of the fine quality of the drilled hole.

If you have the problem of producing holes in extremely hard materials, you need the new hollow cold-point drill or diamond impregnated core bits and a "Buffalo" No. 18 High Speed Hollow Spindle Drill. Use the coupon or write for more details.



Modified "Buffalo" No. 18 High Speed Drill with Hollow Spindle, Coolant Pump, Transfer Unit, Splash Guards and Rubber Flex Collets.

BUFFALO FORGE COMPANY
388 Broadway, Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Please send me details on New "Buffalo" High Speed Drilling Machine:

NAME_____

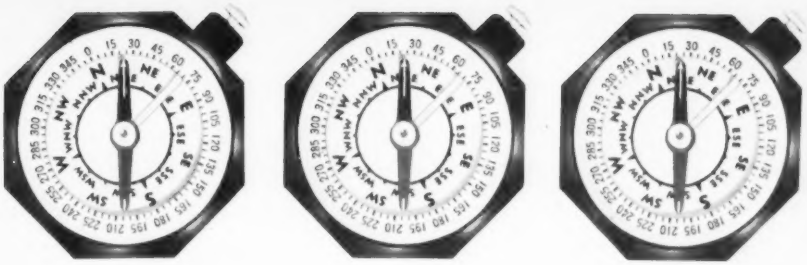
COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

DRILLING ▸▸▸ PUNCHING ▸▸▸ SHEARING ▸▸▸ BENDING

For more data circle 349 on Postpaid Card



POSITIVE DUPLICATION – EVERY TIME!

From a given point, the needles of these compasses always point to the earth's magnetic poles . . . an important aid to exploration and navigation.

The (PD)* marking on these CINCINNATI Surface Grinding Wheels (and *all* CINCINNATI WHEELS) points to an important and remarkable quality . . . Positive Duplication, time after time after time.

CINCINNATI (PD) WHEELS do a better job for you, because 36 separate quality control steps in the unique (PD) process result in wheels of unsurpassed uniformity.

UNIFORMITY TO YOUR ADVANTAGE

Perhaps every wheel manufacturer has complained about the weather and its changing effects on the product. But Cincinnati has followed Mark Twain's advice and has done something about the weather.

Temperature and humidity of the Mold Room are controlled at exact, unchanging levels—every hour of every day *throughout the year!* In addition, (PD) vitrified wheels are fired in a tunnel in unvarying conditions of atmospheric control at critical sections within the kiln.

Result: Each of your re-order (PD) wheels will act and grind exactly like the original wheel.

CALL CINCINNATI

For experienced help in cutting costs, in grinding machine setups and operations, there are Cincinnati grinding specialists available to you. Call your CINCINNATI (PD) GRINDING WHEELS distributor, today, or contact Cincinnati Milling Products Division, Cincnnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI
GRINDING WHEELS

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

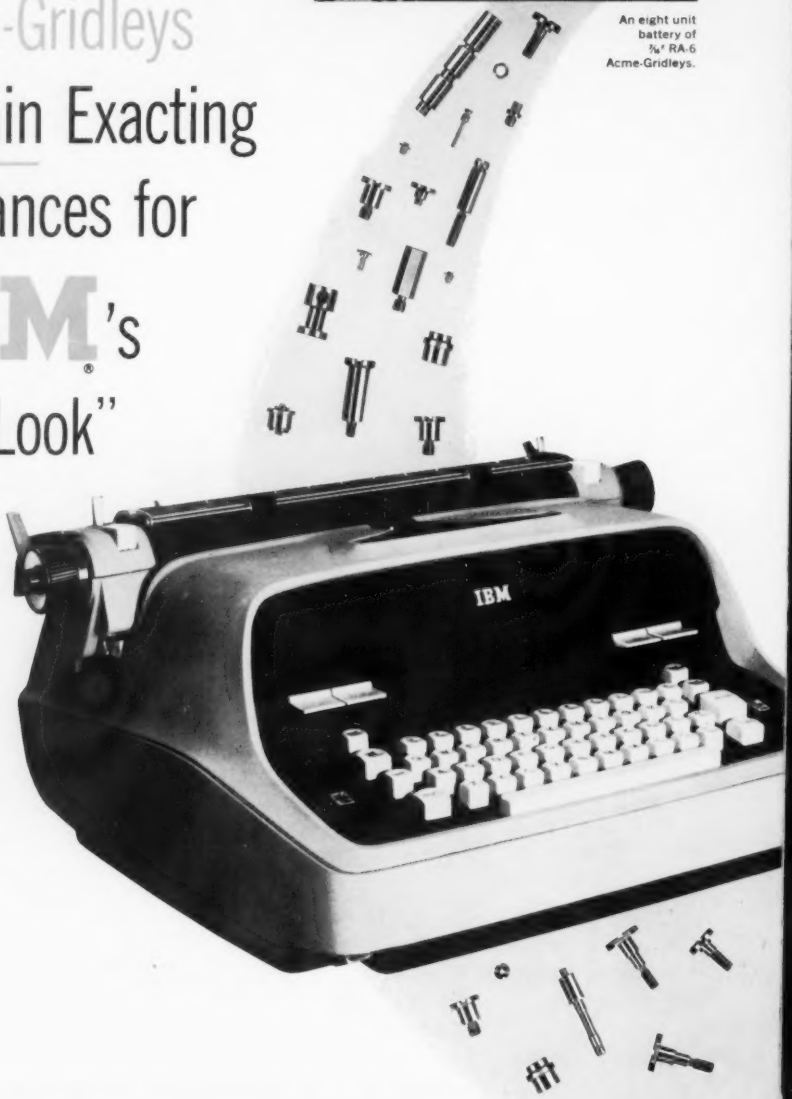
*Trade Mark Reg. U.S. Pat. Off.

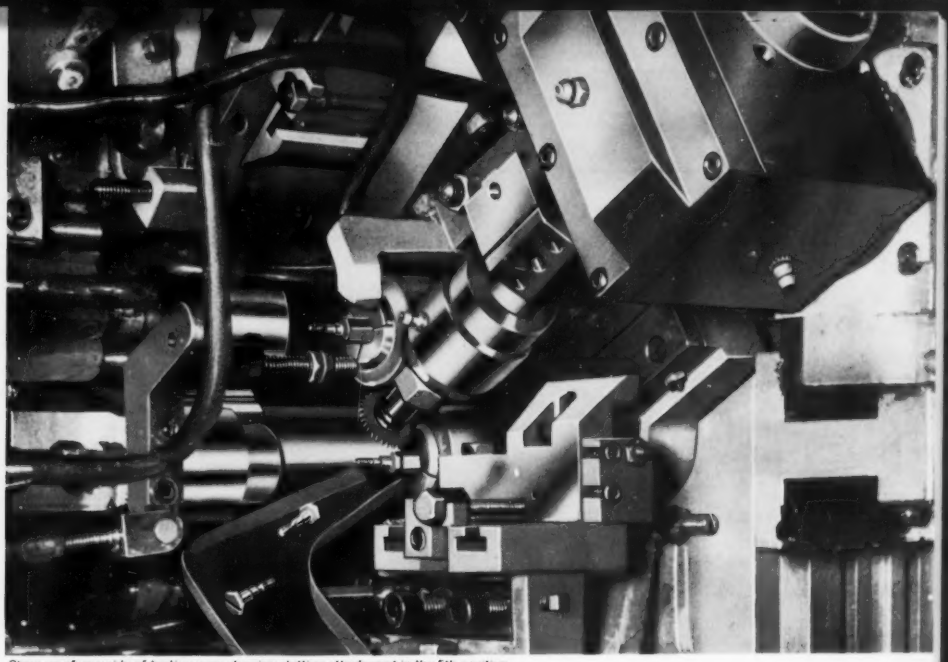
For more data circle 350 on Postpaid Card

First Precision Component in the Run . . . or Last

An eight unit battery of ¾" RA-6 Acme-Gridleys.

Acme-Gridleys Sustain Exacting Tolerances for IBM®'s "New Look"





Close-up of rear side of tooling zone showing slotting attachment in the 5th position.

At IBM's modern Lexington, Kentucky plant, twenty Acme-Gridley 7/16" six spindle automatics are mass-producing the small to miniature parts for their sleek new electric typewriter. They help to provide IBM with greater *sustained* accuracy at lower cost than other comparable machines.

The precision components are held to closely controlled tolerances of .0005 t.i.r. These limits apply to the last piece in the run as well as the first, and consistent accuracy is maintained with less machine adjustment than ever before realized. Sustaining the closely controlled tolerances of these parts completely minimizes costly rejections during exhaustive quality control checks of the completed units. Inspection time is greatly reduced.

IBM has also found that the wide-open tooling zone of their 7/16" Acme-Gridleys permits much greater latitude in tooling up for complicated operations performed in a single set-up. This, plus the lasting accuracy of direct camming and the flexibility of independently operated toolslides, makes this newest member of the Acme-Gridley family a profitable asset to IBM's modern production line. Write for Bulletin MRA-58.

Pioneer in Circumferential Automation

National Acme

The National Acme Company
183 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

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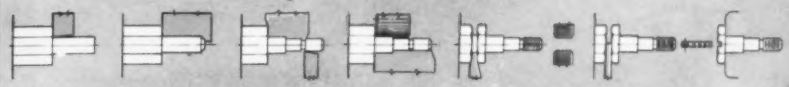
9 Operations In 4.9 Seconds



6. Rough Turn Front End
1. Rough Form and Chamfer Front End
2. Finish Form Two Diameters Finish Turn Thread Diameter
3. Shave Three Diameters
4. Breakdown for Cutoff-Thread
5. Cutoff-Pickup and Slot

JONES & LAMSON
OPTICAL COMPARATORS

the man who needs
a new machine tool is
already paying for it

Tool inspection is easy — same with "hot" stuff

Controlling dimensional limits of new and resharpened cutting tools is mandatory for every manufacturing plant. And it's so easy to do with a J & L Optical Comparator. In fact, the photo above tells the whole story. Just set up the tools and look at the precisely magnified image. Extreme accuracy, ease of operation and low maintenance are the keys to this operation. And they inevitably result in improved quality and lower costs.

In the atomic energy field, too, the same features make the unusual job simple. A customer says: "It is highly advantageous to have J & L comparators in a 'hot' lab — they can be moved from station to station without impairing accuracy, and are easily modified for remote operation."

Whatever your inspection problem, write Jones & Lamson Machine Company, 521 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Precision Boring Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

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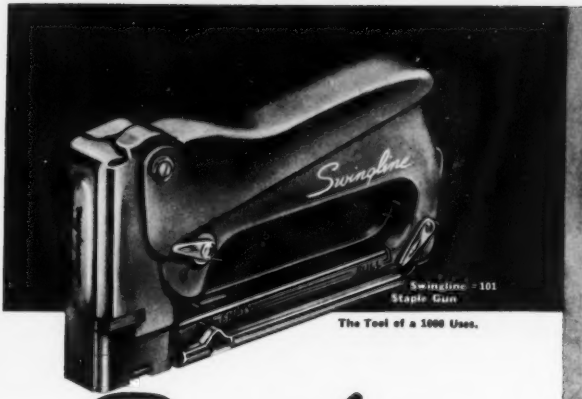
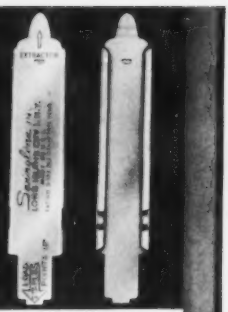


Swingline #101 Staple Gun

The Tool of a 1000 Uses.



FRONT and BACK views of #101 Staple Gun here.

Swingline INC

Manufacturers of staplers, staples & office specialties

Swingline, Incorporated, represents another example of the reliance successful manufacturers place upon U. S. Press Room Equipment.

In the manufacture of their "Swingline No. 101 Staple Gun" Swingline utilizes the U. S. team of "Cradle to Straightener to Slide Feed" — a perfectly matched combination.

Swingline, in the production of their 101 Staple Gun, fabricates the 101 base from .062" coil stock, 1.468" wide. Stock is unwound from a model ACC-1-9C U. S. Multi-Roll Cradle. From the Cradle, stock leads into a model SS-27 U. S. Plain Stock Straightener which removes coil set. The stock is drawn through the Plain Straightener by a model SF-68A U. S. Slide Feed and accurately fed to the press with a feed stroke of 5⅜", at a rate up to 4000 per hour. This particular U. S. Slide Feed has a maximum stock width capacity of 6" and a maximum feed length adjustable up to 8".

As it has for Swingline and many other manufacturers, U. S. Press Room Equipment can help you to produce a fine product, economically. If yours is a press room production operation, get the complete story about U. S. Press Room Equipment by sending for Bulletin No. 85S.

TURNS TO U.S. PRESS ROOM EQUIPMENT

U. S. TOOL COMPANY, INC. AMPERE (East Orange) NEW JERSEY

U. S. Multi-Straw® • U. S. Multi-Miller® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

MULTI-SLIDE

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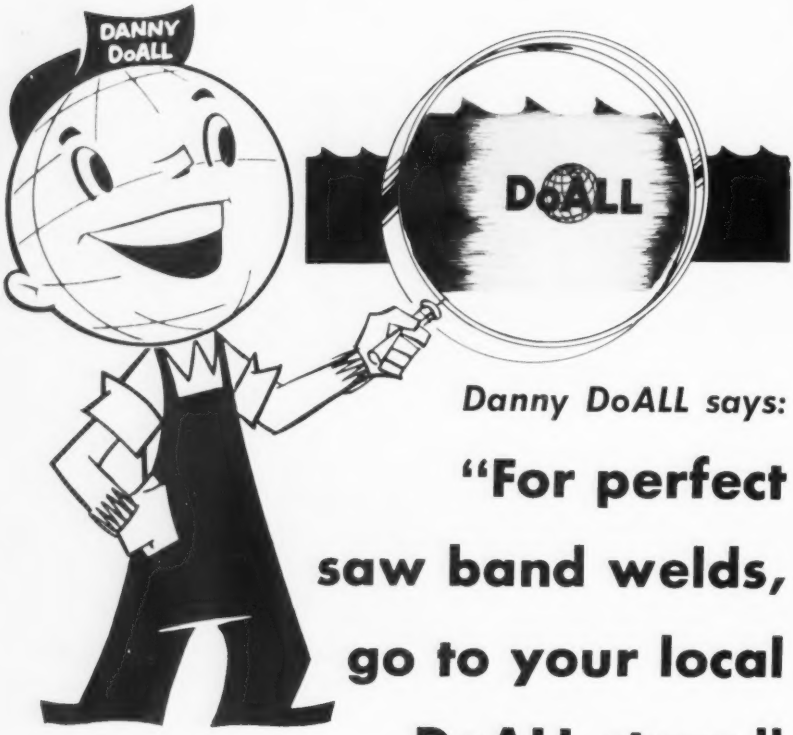

Danny DoALL says:

"For perfect saw band welds, go to your local DoALL store."

SB-71¼

They use the ultramodern HSW-100 welder to produce perfect welds—having 3½ times longer flex life. Welds are guaranteed stronger, teeth perfectly matched and no grinder undercut. You'll get weld perfection in DoALL carbon or HSS saw bands.

THE DoALL COMPANY
DES PLAINES, ILLINOIS

Find Your **DoALL** STORE In The "Yellow Pages"

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How B&W JOB-MATCHED TUBING simplifies fabrication of hydraulic cylinders

. . . The complete range of sizes and types of finish plus close tolerances help to simplify fabricating operations.

. . . Quality control from start to finish in the tube making operations helps to speed up fabrication and to make a better product.

. . . Controlled heat treatment provides desired properties for ease of fabrication.

These are just a few of the reasons it pays to specify B&W Job-Matched Mechanical Tubing.

Call the tubing specialist at your local B&W District Sales Office, or write for Bulletin TB-352 for full information. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

Metal Show • Booth 528
International Amphitheater
Chicago • November 2-6

B&W

THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

TA-9008-SM3

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

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BAY
STATE
3/4-10
NC
H S
GH3
ONE STEP BEYOND
The Marking Is Conventional . . .
With The Exception of
BAY STATE
A full line of taps is not enough. BAY STATE . . . with a deep reservoir of tapping technology . . . goes one step beyond in providing the following surface treatments for more effective tapping of different materials.
Liquid Nitriding — for most effective tapping of cast iron, stainless steel, plastics and abrasive materials.
Flash Chrome Plating — for tapping copper, die castings and cold forming steel.
Steam Oxidizing — for certain taper pipe tapping operations.
Bay State's selected surface treatments are available for all standard and special taps. Specify Bay State . . . the right combination of tap and treatment for precision tapping performance on any tapping problem.
BAY STATE TAPS
Bay State Tap & Die Company • Mansfield, Massachusetts

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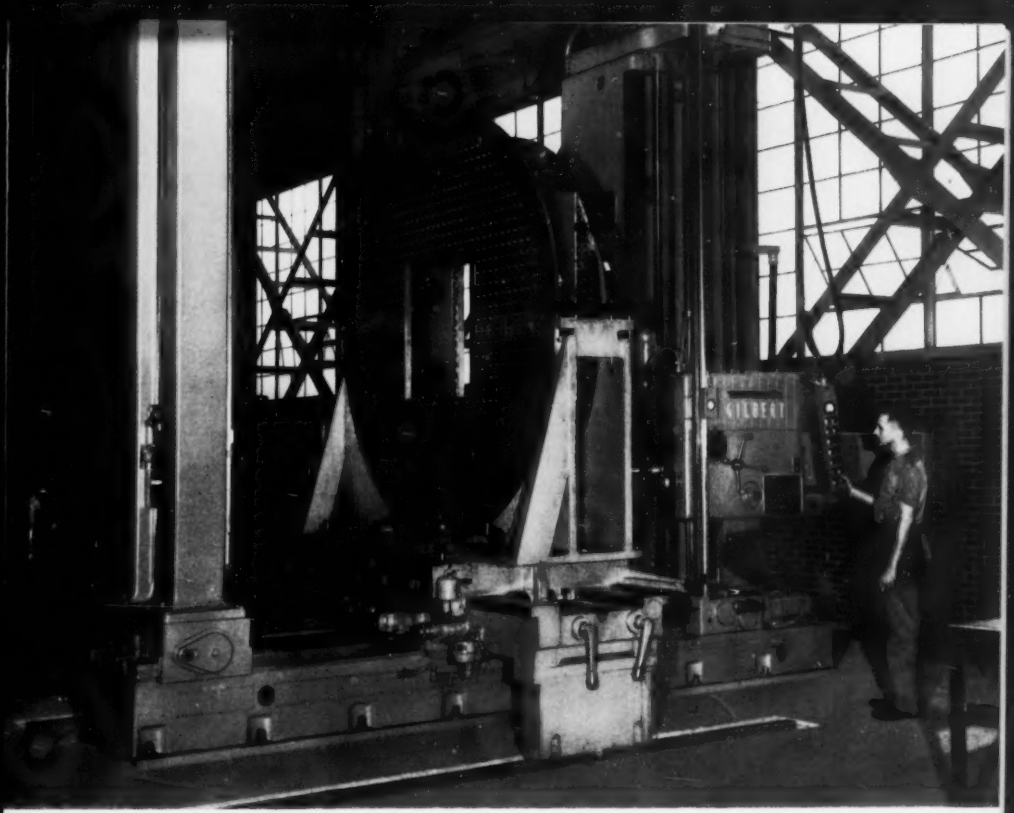

Courtesy Combustion Engineering, Inc.

Combustion Engineering uses Gilberts for precision boring on atomic reactors

It takes an unusual boring mill (specifically, a Cincinnati Gilbert) to meet the specifications on this job:

(a) diameters within .001",

(b) parallelism of center line of holes to center line of plate within .0001" per inch,

(c) parallelism of flat surfaces within .010",

(d) 32 R.M.S. surface finishes.

These are some of the machining requirements on this part for a fast breeder reactor built in the Chattanooga plant of Combustion Engineering, Inc., pioneer manufacturer in the nuclear field. They are typical of the quality of work assigned to this Cincinnati Gilbert table type horizontal boring mill. Automatic positioning makes work-handling fast and precise.

A number of other Gilbert boring mills are producing similar close-tolerance work for Combustion Engineering—proof that "those who buy Gilbert buy Gilbert again."

New Bulletin 1157 will show you why Gilbert boring mills do so many things so well.

The Cincinnati Gilbert Machine Tool Co., 3348 Beekman Street, Cincinnati 23, Ohio.

those who buy **GILBERT** *buy Gilbert again*

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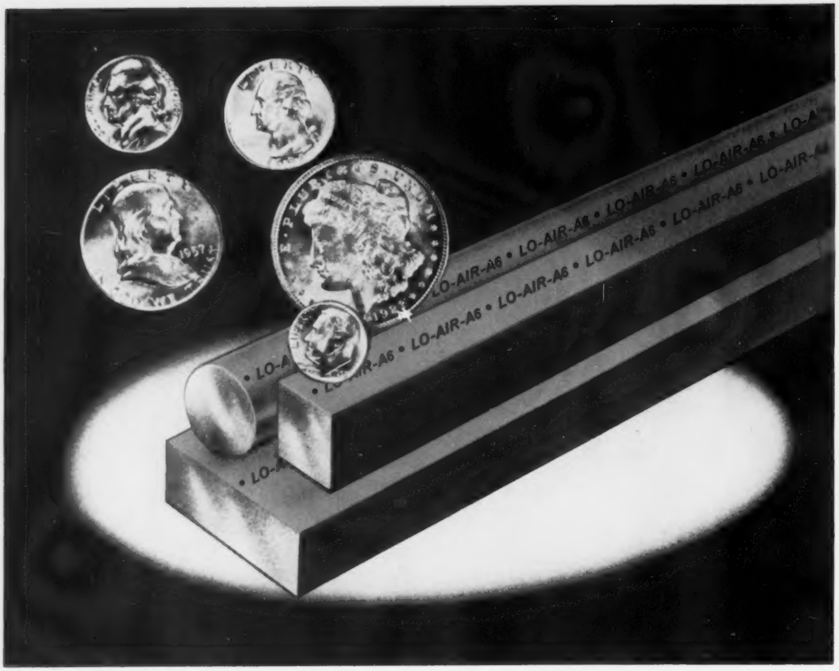

THERE'S A BONUS IN EVERY BAR

LO-AIR TOOL and DIE STEEL

Gives You 4-Way Savings on Every Job

There's 75 years experience in specialty steels behind LO-AIR, Universal-Cyclops low temperature, air hardening tool and die steel. LO-AIR is remarkably free from distortion in hardening, sets new standards for machinability.

Check these four ways that LO-AIR can save you money, help you make more profit.

1. Excellent machinability—far easier than other air hardening grades of tool steels. Easier than oil hardening tool steel.
2. Can be hardened in the low temperature furnace—no need to pay the high cost of high temperature hardening.
3. Less distortion during hardening, which reduces your finishing costs.
4. Maximum safety—possibility of cracking during hardening greatly reduced.

Write for brochure No. TS-101, or start your bonus savings now by ordering your requirements from your nearest Universal-Cyclops sales office or warehouse today! Complete stocks—rounds, flats, squares and billets—available for immediate delivery.

U. S. Pat. No. 2,355,224

UNIVERSAL CYCLOPS
STEEL CORPORATION
BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

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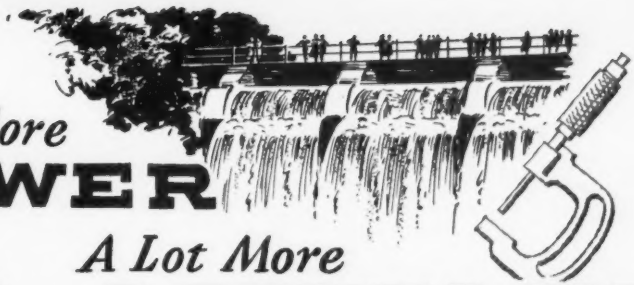
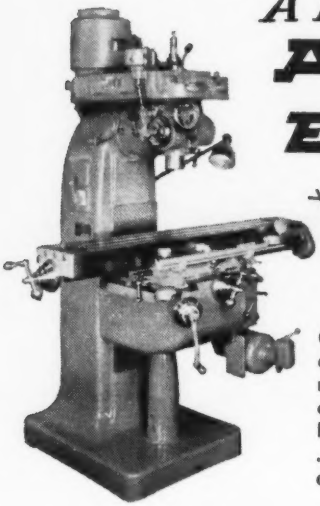


A Lot More
POWER

A Lot More
ACCURACY
***ECONOMY* too!**

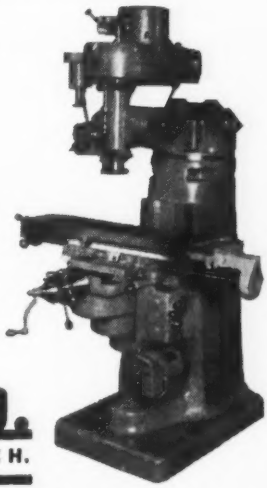


INDEX "SUPER 55" VERTICAL MILL

● 1½ HP Head or optional 2 HP with continuous duty motor gives 50% or more capacity . . . More rigidity, more accuracy . . . Increased horse power and dynamically balanced Cast Iron Pulleys and Drive System afford improved production capacity . . . More weight in the column, heavier ribbed column, heavier knee, heavier saddle.

INDEX "45" VERTICAL MILL

● Unique square design of overarm affords more rigidity, greater accuracy . . . Provides extra range and capacity . . . More power at the cutter. No adjustment required on overarm and head after use . . . No need to re-indicate head after moving overarm . . . Speed range with nine changes makes possible the use of high speed or carbide tipped cutters to best advantage.



INDEX MACHINE CO.
544 N. MECHANIC ST., JACKSON, MICH.

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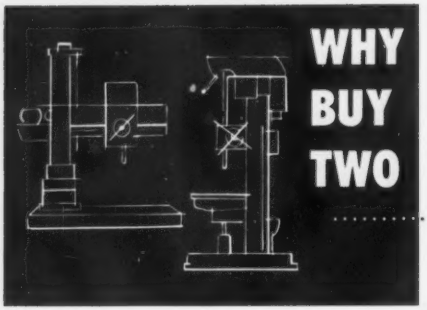
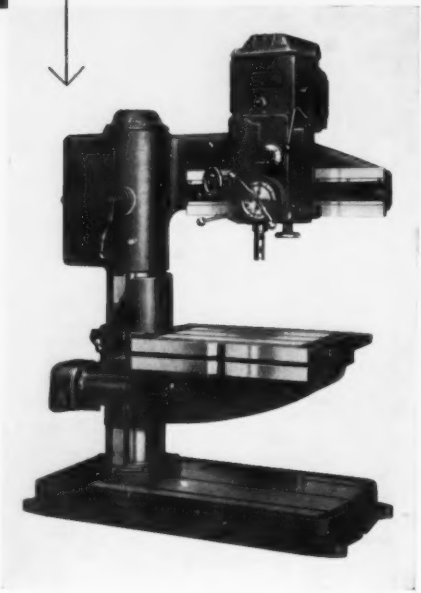


WHY BUY TWO ..... WHEN one WILL DO?

Fosdick's Sensitive Radial combines Upright and Sensitive features—rigidity, compactness and convenient table height—with the capacity and flexibility of a Radial. Fosdick has made the table unusually adjustable, leaving the arm at a fixed height. The unique, one-piece column construction makes possible unusual rigidity. Arm clamping is simplified. You get *all* the advantages of *both* the old reliable drills, at roughly the cost of one!

Workpiece sizes accommodated by the Sensitive Radial include the ranges of both Uprights and Radials; setting up on either the adjustable table or the base of the machine. Controls remain clustered at a constant, convenient operator's height.



YOUR TOOL DOLLAR buys more capacity in less shop space when you put Fosdick's compact versatility to work on your drilling problems. Only Fosdick builds the Sensitive Radial. Call your distributor or write for Bulletin SRA.

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

RADIAL DRILLS
SENSITIVE AND UPRIGHT DRILLS
JIG BORERS & GRINDERS
NUMERICAL CONTROLLED PRECISION BORING MACHINES
SENSITIVE RADIAL DRILLS

FOSDICK

For more data circle 360 on Postpaid Card

PIPE MACHINERY THREAD GAGES

As a precious stone is carefully cut and polished by an expert jeweler—so every Pipe Machinery thread gage is painstakingly lapped by experienced craftsmen to remove soft grinding skin, fat end threads and to produce a low micro finish.

Modern inspection facilities assure rigid operator control during every step of this important lapping process . . . assure a finished product of uniformly high quality with built-in wear life second to none.

When you purchase a Pipe Machinery thread gage, you can be certain the best in material, the best in equipment and the best in human skill have gone into its manufacture.

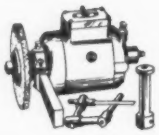
Write today for further information on our complete line of gages.

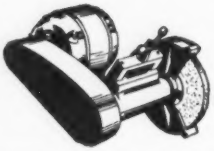
THE PIPE MACHINERY COMPANY · 29100 Lakeland Boulevard · Wickliffe, Ohio · Greater Cleveland

For more data circle 361 on Postpaid Card

• for FASTER . . . EASIER . . . MORE ECONOMICAL GRINDING

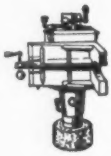
TOOL POST GRINDER

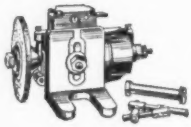




PRECISION LATHE GRINDER

VERTICAL SPINDLE GRINDER





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GRINDING ATTACHMENTS

• for lathes, planers, boring mills, milling machines, shapers etc.

Easily mounted for all supplementary grinding operations. For tool rooms and shops handling a wide variety and range of work from the simplest to the most complicated.

For internal and external grinding, grinding centers, reamers, taps, dies, rolls, journals, crankshafts, cylindrical, surface or special purpose grinding. With or without horizontal or vertical feeds.

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3640 LLEWELLYN ST., CINCINNATI 23, OHIO

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more accurately WITH FLEXOLAP

Flexolap features an expansion barrel with off-center longitudinal slots that "give" under pressure of the adjusting pin —allow up to 15% expansion. Easy, accurate take-up saves valuable time, enables you to lap rounder, straighter holes. Extra flexibility eliminates danger of galling or seizing.

SET NO. 1

includes 6 complete laps, one of each size (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2"), and one additional brass barrel of each size, all on a sturdy stand. $14.00

OTHER SIZES

available are 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16", 3/4", and Midget Laps in sizes .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218 and .250. Trial assortment of 17 midget laps, $2.10

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Cut costs here

Free-machining DESEGATIZED® HIGH ALLOY DIE STEELS

4

grades regularly stocked for long-run die applications...

- **OLYMPIC FM** (Type D-2)
  ...for typical long-run applications
- **BR-4 FM** (Type D-7)
  ...for extreme abrasive service
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  ...to meet non-deforming requirements
- **COBALT CHROME FM** (Type D-5)
  ...for extra resistance to galling and pickup

Latrobe's 12% chromium die steels are easier to work, easier to machine . . . because they contain evenly-dispersed, fine alloy sulphides which permit faster speeds and feeds, and result in better machined surfaces.

As a result of Latrobe's DESEGATIZED process of manufacture, these steels are fully-uniform . . . free of harmful carbide segregations. They're tougher, respond readily to heat treatment, and possess unusual wear resistance characteristics.

For better die steels and technical service, call your Latrobe representative today!

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LATROBE, PENNSYLVANIA

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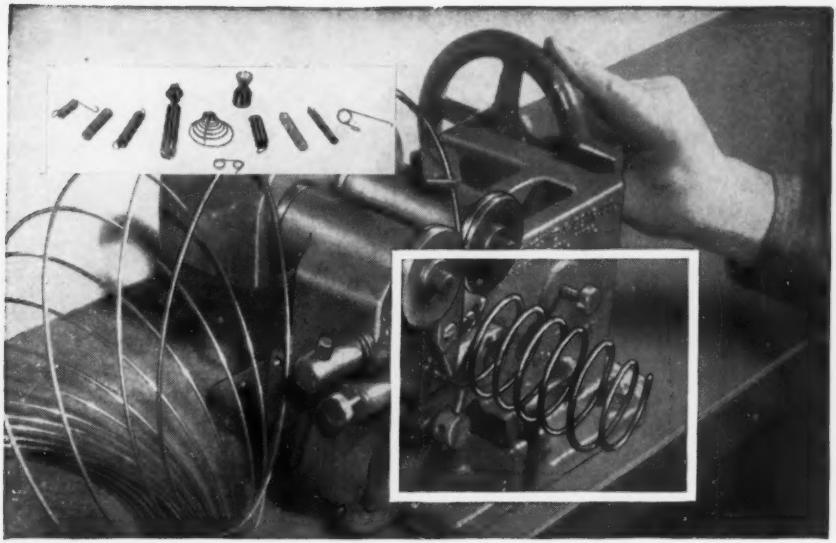

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WITHOUT USE OF ARBORS

For a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005″ to .125″, you can produce it in a matter of seconds with Perkins Precision Spring Coiler. You eliminate arbors, yet turn out precision springs — torsion, compression, extension, tapered, or special springs, coiled either left or right hand, in any desired length, any diameter from 3/32″ to 12″ and larger, with or without initial tension, and with open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications as replacements or experimental work. Make them fast, right in your own shop!

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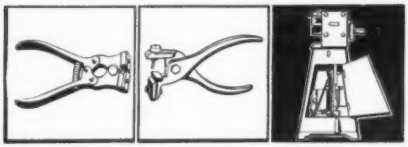
MACHINE AND GEAR CO.
Special Machinery Division,
West Springfield, Mass.



Starrett adjustable jaw cut nippers (left) and Gardener Hook-Kon spring looping tool (center) — handy, precision, time-saving accessories for spring coiling. Perkins Spring Coiler available as bench model or power model shown here, (right) for tool shop or continuous runs.

Perkins Machine and Gear Co.
Special Machinery Division, Dept. D1
W. Springfield, Mass.
Please send information and prices on Perkins Spring Coiler.
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Meetings

Important Meeting Dates

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

OCTOBER 7-9 • Gray Iron Founders Society Inc., Annual Meeting, Fairmont Hotel, San Francisco. Society headquarters: 930 National City-E. 6th Bldg., Cleveland 14, Ohio.

OCTOBER 8-10 • American Society of Tool Engineers, Semi-Annual Meeting, Chase-Park and Plaza Hotels, St. Louis, Mo. Society headquarters: 10700 Puritan Ave., Detroit 38, Michigan.

OCTOBER 19-20 • Magnesium Association, Annual Meeting and Exhibit, Roosevelt Hotel, New York. Association headquarters: 122 E. 42nd St., New York 17, New York.

OCTOBER 19-21 • American Institute of Electrical Engineers, Machine Tool Conference, Sheraton-Cleveland Hotel, Cleveland. Institute headquarters: 33 W. 39th St., New York 12, New York.

OCTOBER 19-23 • National Safety Council, Annual National Safety Congress and Exposition, Conrad Hilton, Congress, Sheraton, Morrison and La Salle Hotels. Council headquarters: 425 N. Michigan Ave., Chicago 11, Illinois.

OCTOBER 20-22 • American Society of Lubrication Engineers and American Society of Mechanical Engineers, Joint Annual Conference on Lubrication, Sheraton-McAlpin Hotel, New York City. A.S.L.E. headquarters: 5 North Wabash Ave., Chicago 2, Illinois.

OCTOBER 25-27 • American Machine Tool Distributors Association, Annual Meeting, Statler-Hilton Hotel, St. Louis. Association headquarters: 1900 Arch St., Philadelphia 3, Pennsylvania.

OCTOBER 25-28 • American Gear Manufacturers Association, Semi-Annual Meeting, Edgewater Beach Hotel, Chicago. Association headquarters: 1 Thomas Circle, Washington 5, D. C.

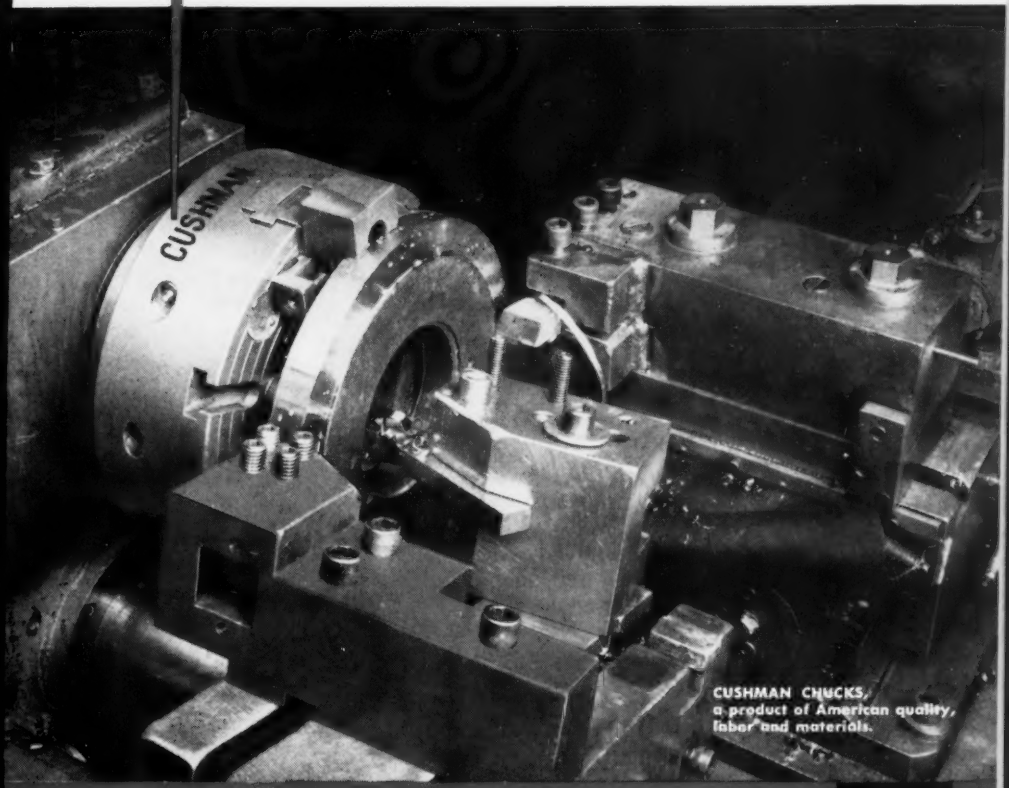
OCTOBER 29-31 • National Metal Trades Association, Annual Meeting, Sheraton-Biltmore Hotel, Providence, R. I. Association headquarters: 337 W. Madison St., Chicago 6, Illinois.

Beat production quotas and costs with:

Cushman air operated CHUCKING EQUIPMENT

Cushman, the leading manufacturer of air operated chucking equipment, has designed and built a complete line of air operated chucks, cylinders and accessory equipment engineered to meet modern machine tool requirements of heavier feeds at higher speeds, maintain repetitive precision accuracy and positive gripping with truly fast workpiece chucking and unchucking.

Write today for your copy of Bulletin PO-65D and see how you, too, can effectively beat production quotas and lower machining costs by using efficient, economical Cushman Air Operated Chucking Equipment.



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labor and materials.

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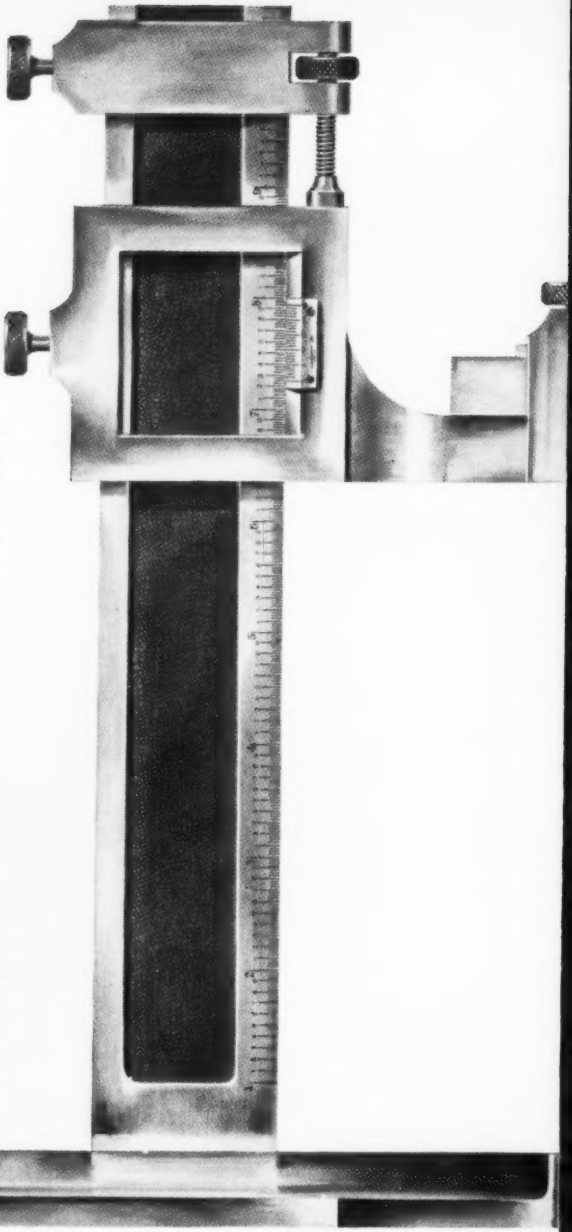

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.

The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

You can produce greater savings than you can buy

You can't recognize a value by its price alone. This is true of all types of grinding wheels and has special significance in diamond wheels in view of their high initial cost.

The only accurate measure of the value of any grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton diamond grinding wheels are worth more to you —

Norton Company introduced all three diamond wheel bond types, does all its own sizing and checking of diamonds — duplicating wheel specifications with constant accuracy. Norton certifies the carat content, assuring full value for your money. Whether the diamonds you use in grinding are mined or man-made, Norton gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field. And you get this great scope of detailed knowledge on a personal basis — your Norton Man.

The Norton Man spends a minimum of one year in a thorough Norton training course, and a comparable period of field training. In addition to field training he has an average of 15 years' abrasive experience. Make your Norton Man your consulting abrasive engineer.

Your Norton Man will be glad to make an Abrasive Requirement Study of each abrasive job in your plant, to assure you lowest cost-per-piece produced. Also he has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at lowest cost. And with Norton grinding wheels you can be sure of precise duplication, order after order.

For true abrasive economy that pays off in lower cost-per-piece produced — call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world. W-1917

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58-20

Here's Why Continental Counterbore Drives

Never Bind! Never Fail!

Continental Counterbores operate precision-smooth and detach with a *twist of the wrist* because the driving forces generate *compressing* not *shearing action* in the holder. They *never* bind, deliver long-lasting, trouble-free operation.

In Continental Counterbores, you get extra torsional rigidity because drive lugs are close to the seating shoulder of the cutter. Double lugs on the cutter engage double abutments in the holder to form a powerful tool. But best testimony to the satisfaction you get from these counterbores is this: *no one has ever reported failure of a Continental Counterbore Drive*! For more information, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit. Available individually or in a choice of three sets.

Continental
TOOL WORKS

Division of CTW
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

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SET KNIFE CLEARANCE AT 8% OF METAL THICKNESS

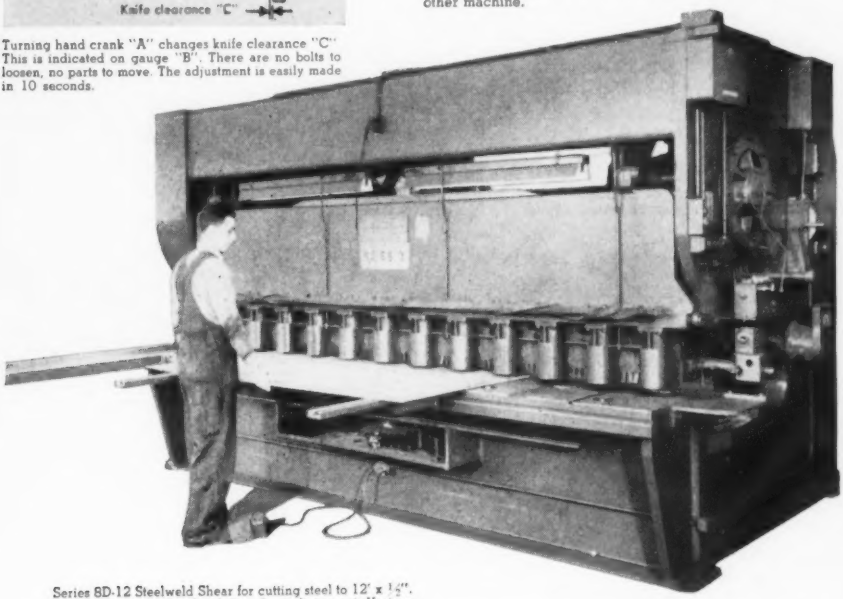
Turning hand crank "A" changes knife clearance "C". This is indicated on gauge "B". There are no bolts to loosen, no parts to move. The adjustment is easily made in 10 seconds.

8% is a good figure to remember when shearing mild steel. By adjusting the clearance between the knives to 8% of the thickness of steel being cut, you will get the best cuts and the knives will stay sharp longer.

Because of the importance of having the right knife clearance for every shearing job, Steelweld Shears were designed to make this adjustment extremely easy. In fact, it can be made in 10 seconds. Consequently, it becomes a natural routine part of a shear operator's job.

You will find this feature invaluable if you shear various thicknesses. It eliminates the need of working with some fixed compromise knife clearance setting with resultant cuts that vary from the ideal more or less as the knife adjustment is off from the correct setting.

Steelweld Shears are the most modern on the market today with more features that make for speed, accuracy and long trouble-free operation. Some of their fine features are not obtainable in any other machine.



Series SD-12 Steelweld Shear for cutting steel to 12' x $\frac{1}{2}$". A stainless steel plate 7' x $\frac{3}{8}$" is shown being cut. Various thickness plates, as well as heavy steel grating, are also cut on this machine, which is in a West Coast plant. Knives on this hard-working shear last 3 to 6 months before they need to be turned to another cutting edge.

Write for free copy of Catalog No. 2011
Gives construction and engineering details

STEELWELD
PIVOTED BLADE **SHEARS**

THE CLEVELAND CRANE & ENGINEERING CO.
6454 East 282nd St., Wickliffe, Ohio
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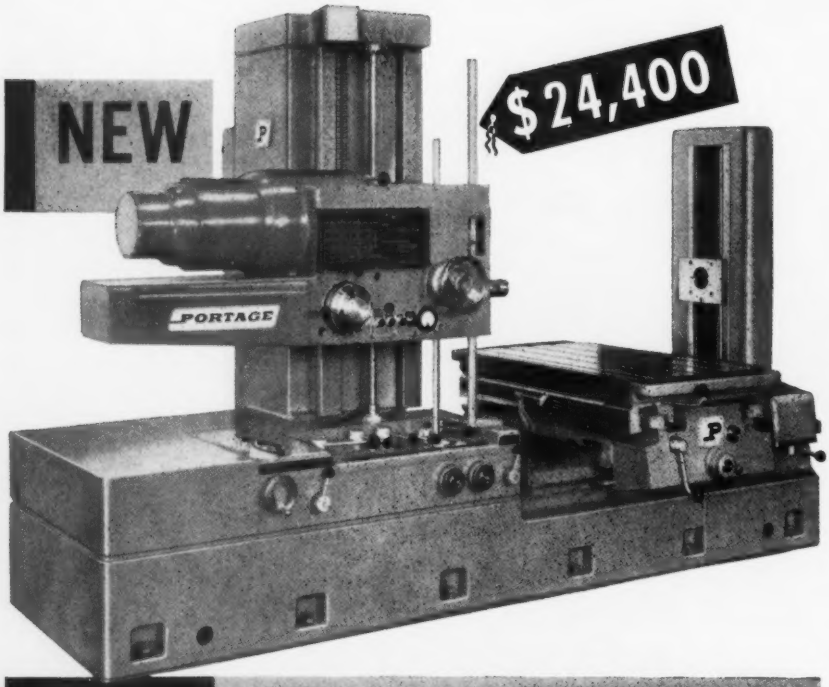

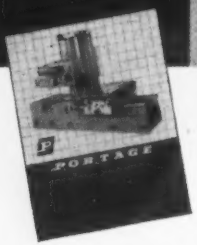

Literature, just off the press, covers features and specifications.

See our catalog in Sweets

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Mr. Buyer... here's a 3 inch bar machine you can't afford not to investigate. It's new from the top of the column to the bottom of the base... All new speeds and feeds, plus a versatility of job applications make it a real money maker. All new construction features offer a truly strong, rugged machine... and the pay-off... it's priced amazingly low, every shop can afford one ...write, wire or phone for complete information.

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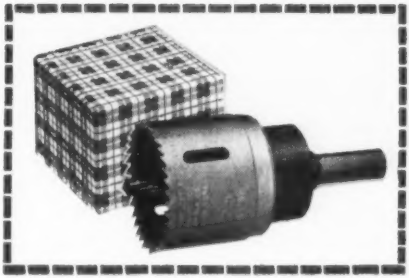
shatterproof LENOX HOLE SAWS

Even when the going is *extra rugged* — the LENOX HOLE SAW performs with precision and dependable safety. The specially-designed, extra tough alloy back of the saw produces a cushion-like effect that absorbs the cutting impact. Dangerous shattering is completely eliminated, while saw breakage is negligible.



High speed steel welded edge

LENOX
THE TOOLS IN THE PLAID BOX

AMERICAN SAW & MFG. COMPANY
SPRINGFIELD, MASSACHUSETTS • U.S.A.

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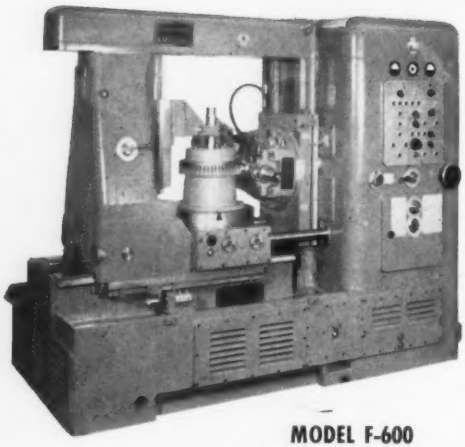
For Sheer Versatility in take a look at



MODEL F-600
for gears up to 24″

Michigan - Lorenz hobbers and gear shapers actually combine versatility and productivity without compromise in either direction. For both the job-shop and the mass production man, they offer a combination of accuracy and economy hard to beat. They are U. S. versions of the famed Lorenz line. For example, all motors and controls are of U. S. manufacture. All settings and dials are in U. S. measure. They will give you all you are looking for in versatility and productivity . . . plus accuracy, rigidity and tool life that will surprise you.

LOOK AT THESE FEATURES!

REAL VERSATILITY IN A PRODUCTION MACHINE—Infinitely variable hob speeds (20 to 400 rpm) by setting a control knob.

Infinitely variable feeds within range of machine through hand knob adjustment.

Automatic 1-cut work-cycle.

Automatic 2-cut cycle with automatic feed and speed changes; step hobbing.

ACCURACY ONLY REAL RIGIDITY CAN GIVE

Closed frame; trough overarm brace hydraulically locked during hobbing reduces vibration to a minimum.

Maximum rigidity during hobbing by hydraulic clamping of worm table and overarm work support.

Large precision-made index worm and gear table drive with backlash controlled by axial worm adjustment.

Accurate hob spindle drive through precision ground spur gears and accurate dual-lead worm gear set. Backlash controlled by axial adjustment of worm.

Ground spur gear differential for accurate hobbing of helical gears.

Micrometer setting for infeed control.

LONGER TOOL LIFE; LESS DOWN-TIME—Vibration, enemy of tool life, is cut.

Increment hob-shift or diagonal hobbing to distribute hob wear.

AUTOMATIC LUBRICATION — Recirculating type. Force-feed lubrication to hob spindle bearings, etc.

RESERVE POWER AND SMOOTHNESS—Ample power reserve. Maximum smoothness through motor-generator DC drive.

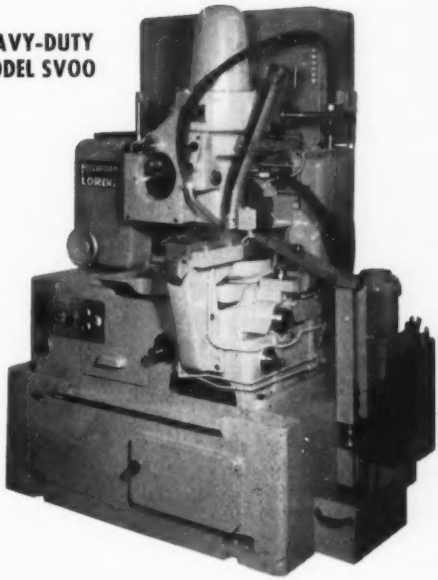
Production Hobbers & Shapers the MICHIGAN-LORENZ line

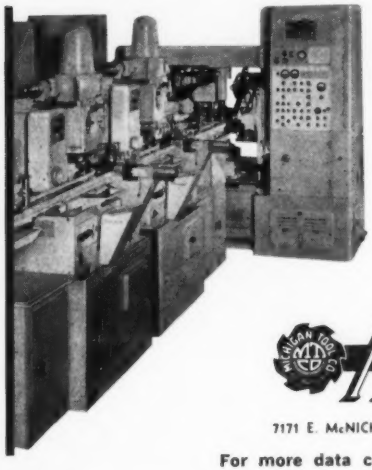
Despite their high versatility, Michigan-Lorenz Gear Shapers are easily tooled for semi-automatic or completely automatic gear production within their full capacity range, as shown below. Available also with automatic change in cutter speed and rotary feed between rough and finish cuts, and for automatic spindle stop at top of stroke, and saddle retraction for ease of loading when cutting internal gears.

Rigidity and accuracy are outstanding. Examples: the cutter spindles are 3⅜ in. diameter; precision-made upper and lower index worm gear drives; accurately interconnected for maximum work accuracy.

For narrow face gears, the model SRO is specially designed to provide up to 900 strokes per minute.

HEAVY-DUTY MODEL SV00





A phone call, wire or letter will bring you the whole story.

MICHIGAN TOOL Company

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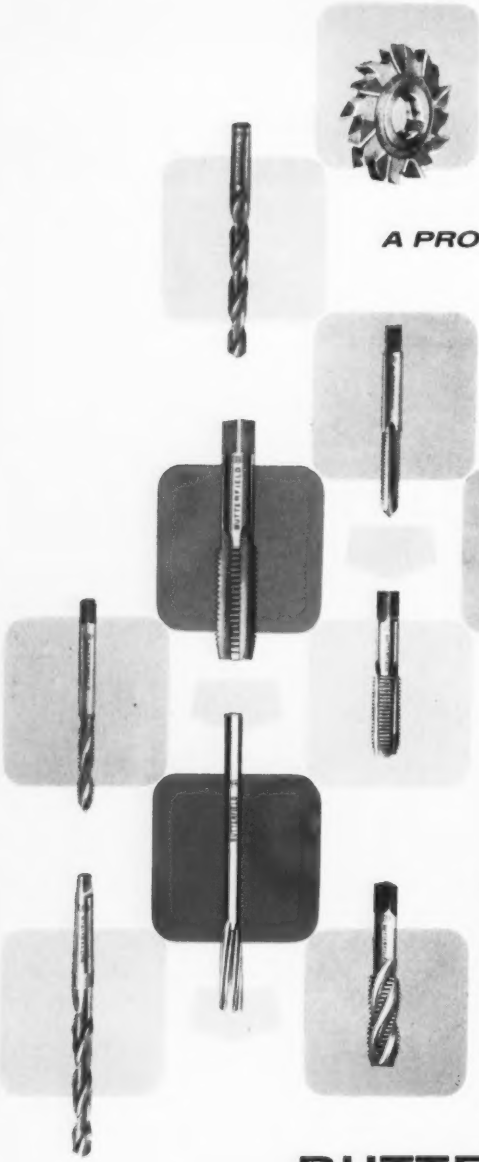

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BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

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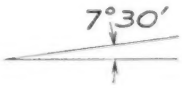
This is a knock-out cavity bushing.

It is used in plastic injection molding.

It is manufactured by *FASTEX,*

Division of Illinois Tool Works, Des Plaines, Illinois.

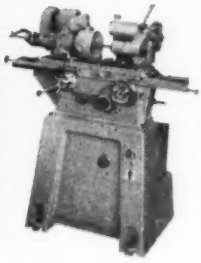
It has a 

internal taper.

It is ground from hardened tool steel, 58-60 Rockwell C

The tolerances must be held to 0.0002"

The grinder on which this bushing and all its cousins are made is a



Model 84
An internal specialist with external ability. Mounts interchangeable wheelheads for internal and external spindles. Capacities are 3" diameters, depth 4". Collets and step chucks mount directly in lathe-type spindle.

RIVETT LATHE & GRINDER, Inc.
Dept. MMS-10 Brighton 35, Boston, Mass.

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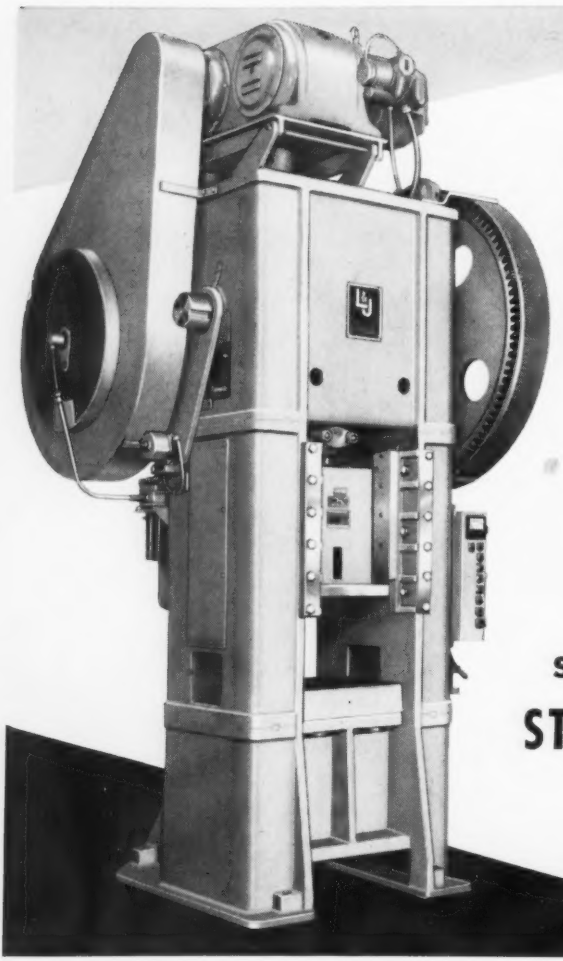

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Air clutch and brake. Four square type gibs with bronze surfaced ways on ram. Hard bronze crankshaft bushings and ball seat. Ram counter-balances. Forced lubrication, J.I.C. controls, etc.

Write — Bulletin L-18 on 20 to 150 ton single and double crank straight side presses . . . also, 30 to 75 ton gap frame presses.

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largely eliminate the necessity for special compounds or special operations setups. Silicon Carbide and Aluminum Oxide grains, grades extra fine to extra coarse, in soft, firm and tough rubber binders.

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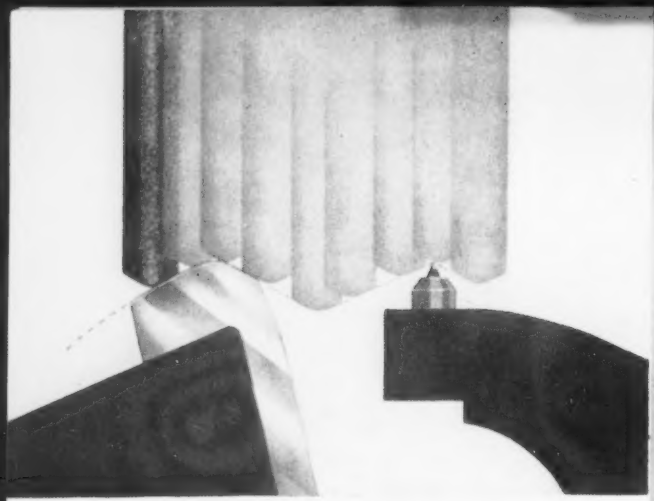


OLIVER'S FACE MILL GRINDER features automatic wheel dressing with every stroke

The drawing above shows the grinding wheel passing over a cutter tooth after being dressed and formed automatically by a fixed diamond. This happens with each stroke of the Oliver automatic face mill grinder. This exclusive Oliver of Adrian feature permits carbide grinding with a silicon carbide wheel. Automatic feed-down accurately compensates for each dressing thus providing a fixed grinding line which insures a minimum of run-out.

The machine automatically indexes the cutter and controls the tooth shape by a simple cam arrangement so that any practical roughing or finishing form can be obtained. Oliver's face mill grinder is hydraulically operated for smooth, fast (4 to 8 times faster per cutter), accurate and trouble-free performance.

In addition to the automatic machine, Oliver also produces a hand operated, heavy duty machine for all types of face mill grinding on coarse and fine pitch cutters from 4" to 24" in diameter. Still a third machine in this general family is the Oliver No. 2 Arc Radius Cutter Grinder for face mills and cutters requiring a radius on the corner.

Oliver will grind face mills on a "no charge" basis as a demonstration of the ability of the machines. We'd like to work with you—write today.

OLIVER of ADRIAN

1430 E. Maumee St. • Adrian, Michigan

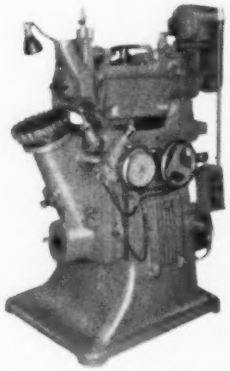
DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES.

A "TRIPLE CHECK FOR FACE MILLS

To obtain peak performance in your face milling operations you must be certain to achieve (1) maximum cutter life, (2) lowest possible micro-inch reading on the surface being milled and (3) the most economical method of sharpening the cutter.

Check your performance to see if you are using all three of the following helpful hints:

1. Maximum cutter life requires the elimination of all sharp corner angles which are normally subject to early breakdown. The Oliver face mill grinder automatically incorporates a corner radius between the face and the lead angle thus correcting this situation. A test grind on your face mill will show a substantial increase in pieces milled per grind.
2. For the finest finish a radius should be used on the face rather than a straight line grind. The face radius



(40" to 100") eliminates the line contact which is largely responsible for the rougher milled surfaces. Standard cams include this feature automatically on the Oliver machine.

3. Minimum grinding costs require the use of fast, automatic machines capable of using semi-skilled operators. The Oliver face mill grinder provides for complete automatic operation, including the indexing as well as the grinding of the lead angle, corner radius, face, dish and the removal of the soft steel backing on carbide tipped cutters. The automatic up-feed of the cutter is an optional feature.

For more data circle 379 on Postpaid Card

COST CONSCIOUS?

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FULMER

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COST LESS

. . . To Purchase

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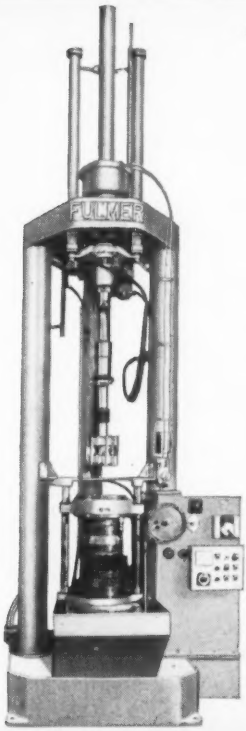

Fulmer Honing Machines are better designed for accurate performance . . . better constructed for years of economical operation . . . None more flexible or easily modified. All This—And never a charge for Service!

Cost conscious customers—
call FULMER

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WORLD'S BEST

Honing Machines

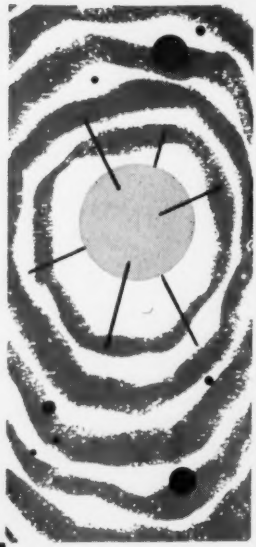
For more data circle 380 on Postpaid Card

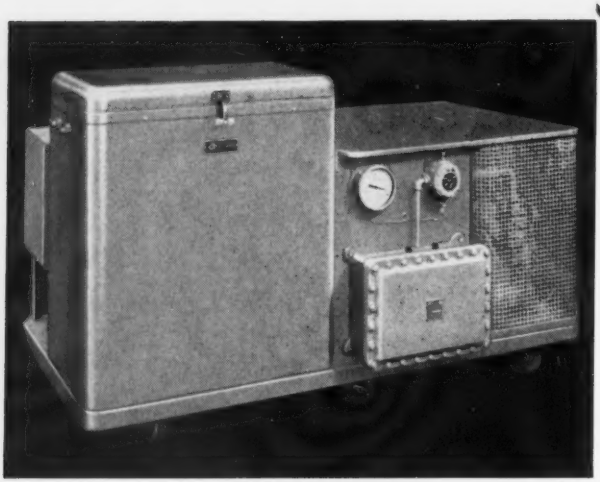
At the Metal Show . . .

CINCINNATI SUB-ZERO PRODUCTS

will exhibit its equipment for
shrinking, testing, stabilizing metals

See ultra low temperature equipment for stabilization of alloy steels . . . improving magnetic qualities . . . normalizing castings to eliminate distortion and costly grinding operations, reduce production costs.





Production chilling of stabilizing shafts utilizes this Cincinnati Sub-Zero unit, with temperature range of —70 to —150°. Chills 150 lbs. of steel hourly . . . 4000 BTU/hr at —120°F.

Write for full-line catalog. **See our exhibit . . . Booth 1756**

Member: Environmental Equipment Institute

CINCINNATI SUB-ZERO PRODUCTS

General Office & Plant
3930-S-9 Reading Road • Cincinnati 29, Ohio
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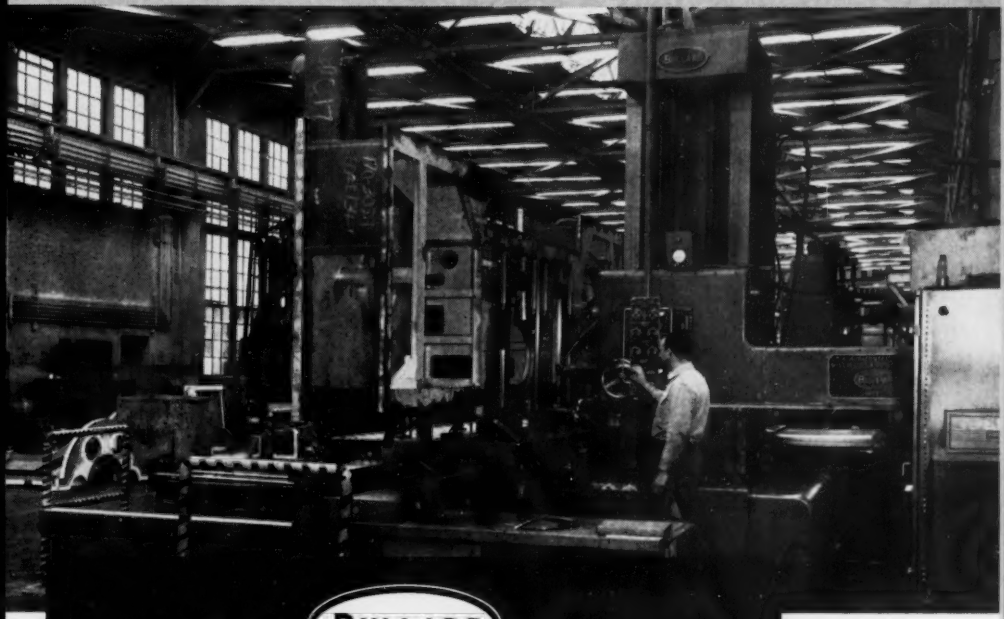
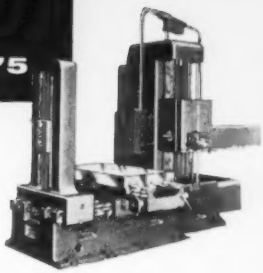
GET *MORE FOR YOUR MONEY



. . . with a BULLARD

Horizontal Boring Machine • Model 75



The Gas Turbine Department of the General Electric Company, Schenectady, N.Y., recently installed a Bullard Horizontal Boring Machine, Model 75. We are confident that they got more for their money.

This "*MORE" includes: —

GREATER RIGIDITY — heavier cuts at higher speeds.

PRECISE ACCURACY — hold boring tolerances to .0005.

TABLE OUTBOARD SUPPORTS — provides work alignment even with unbalanced table load.

PENDANT CONTROL — full machine control from position most advantageous to operator.

CHROME HARDENED WAYS — on Bed and Saddle for longer wear.

BED LEVELS — built into Bed for easy checking.

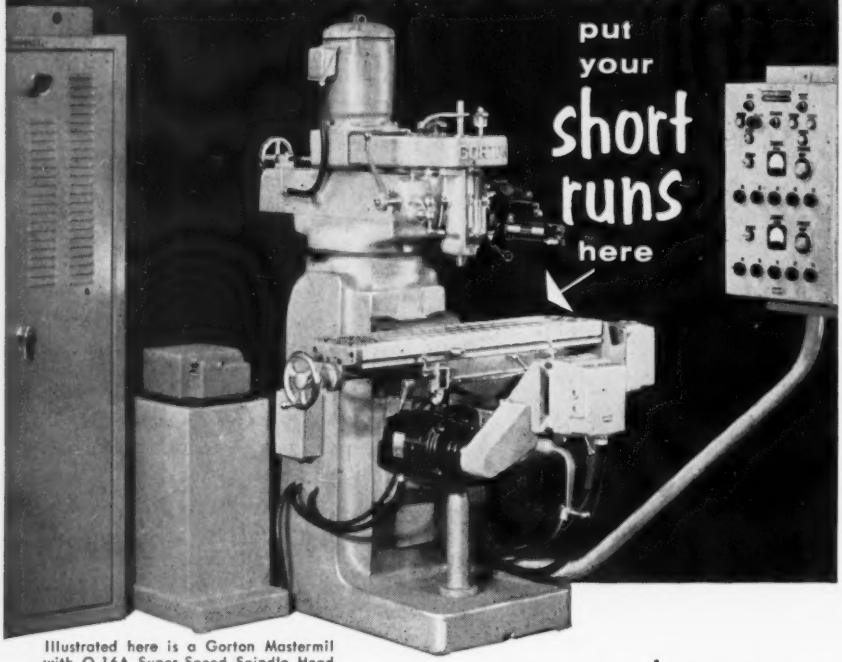
FAST SERVICE — after two years of operation, little trouble, and minor complaints handled promptly.

Investigate and compare and you, too — will discover you get more for your money with a Bullard H. B. M., Model 75.

ASK YOUR BULLARD SALES ENGINEER OR WRITE FOR FULL SPECIFICATIONS TO.....

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

FOR NUMERICAL CONTROL AT LOWEST COST



Illustrated here is a Gorton Mastermil with O-16A Super-Speed Spindle Head and Ram Assembly with G. E. Mark II Numerical Control System.

GORTON NUMERICAL CONTROL

is field tested and proved in use

This is how Gorton Numerical Control saves you money on short runs:

- —eliminates elaborate and costly tools, dies, jigs and fixtures
- —wastes no time because operator does not "pace" the work
- —makes no mistakes because operator skill not required
- —extreme, repetitive accuracy is easy and automatic
- —change overs in set-ups can be made quickly
- —signals operator when tool changes are needed
- —guides cutter in close quarters without damage to work or cutter
- —making punched tape is simple typewriter operation

Punched tape . . . or magnetic tape control . . . is available to you on SIX standard Gorton machines and also on Gorton custom-designed machines. You'll be agreeably surprised when you learn the low cost of Gorton Numerical Control and how much more it gives you for your money. For full information write

Saves You Money on—

- face milling
- side milling
- end milling
- straight line cavity milling
- slotting
- drilling
- reaming and boring

Your letterhead inquiry will receive prompt attention.

GORTON

SINCE 1893

GEORGE *GORTON* MACHINE CO.

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Tracer-Controlled Pantographs, Duplicators—standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

For more data circle 383 on Postpaid Card 1017

NEW! Norton TUMBLEX* abrasive now available in "RP" and "TP" pin shapes for finer, faster finishing of intricate parts

New TUMBLEX "RP" (Round Pin) abrasive, size ¾" diameter x ⅝" length, is ideal for finishing a retainer ring with round holes on sides and ends.

New TUMBLEX "RP" (Round Pin) abrasive, ⅜" diameter x ⅝" length, reaches all areas of cylindrical serrated missile part with center hole.

Like the long popular TUMBLEX "T" (Triangles) and "S" (Spheres) barrel-finishing abrasives, the new "RP" and "TP" types are made of bonded ALUNDUM* abrasive — fast-cutting and lustre-giving. Their round and triangular pin shapes are particularly designed to deburr and refinish parts with holes, slots, serrations and other hard-to-contact recesses — in shortest time at lowest cost.

Send samples of parts you finish — any sizes or shapes — to our Sample Processing Department. We'll barrel-finish with the new "RP" and "TP" abrasive, or with any more suitable TUMBLEX type and tell you the abrasives, methods and equipment you need most. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

New TUMBLEX "TP" (Triangular Pin) abrasive, ⅛" side width x 1" long, gives faster, smoother finish to slotted and notched hydraulic valve unit.

NORTON
ABRASIVES

G-376

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

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NEW!

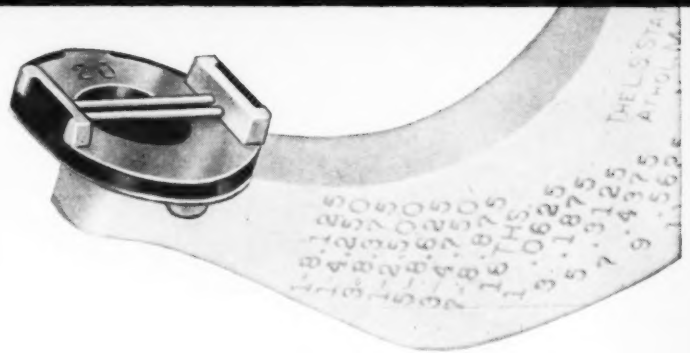
CARRIERS

for 3-wire thread measuring

10 TIMES FASTER THAN HAND-HELD WIRES

Easiest, most practical way of measuring threads by 3-wire method. Makes thread measuring as easy as plain O.D. checking!

- **LONGER WIRE LIFE — TROUBLE FREE!**
- **NO HAND CONTACT — NO CORROSION FROM PERSPIRATION**
- **NO WIRE BENDING OR LOSS**
- **USE FAMOUS VAN KEUREN WIRES**
- **MEASURE ALL STANDARD PITCHES**
- **FLOATING WIRES — CARRIERS CANNOT INTERFERE WITH POSITIONING**
- **EACH SET OF CARRIERS AND WIRES IN SEPARATE VIAL WITH FULL DATA**
- **ADAPTERS PERMIT USE OF "MIKE" CARRIERS ON MEASURING MACHINES**



Use them for: **CHECKING THREAD PLUG GAGE WEAR**
IN-PROCESS INSPECTION
RECEIVING INSPECTION

FOR MICROMETERS — FOR MEASURING MACHINES

MICROMETER CARRIERS are made to fit Starrett Micrometers (.234 spindle and anvil diameter; anvil height .070" min.) and will measure the pitch diameter of American National and Unified 60° threads from #0 through ¾" diameter; all standard threads, 10 through 80 TPI. Sets, in deluxe mahogany case, contain 19 pairs of carriers and wires for the above range, plus micrometer and pair of measuring machine spindle adapters. May be ordered without micrometer and/or adapters.

MEASURING MACHINE CARRIERS are made to fit Pratt & Whitney Measuring Machines (.375 spindle and anvil diameter). Set covers all standard threads, #0 through 1" and 8 through 80 TPI.

Ask the *Man-from-Standard* for demonstration or write for BULLETIN 59-2.

Patents applied for

STANDARD GAGE COMPANY, INC.

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A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE TYPES

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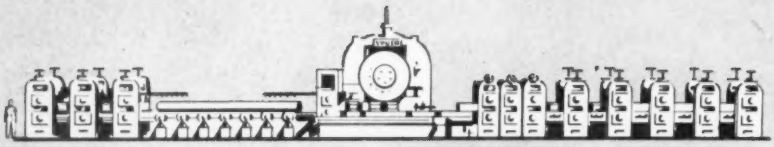
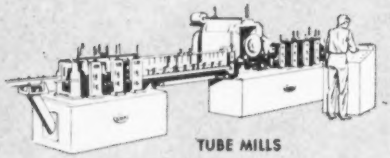
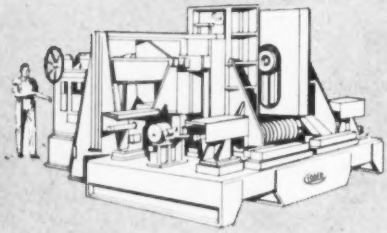


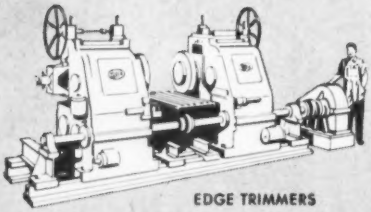
PIPE MILLS



TUBE MILLS



HEAVY DUTY UNCOILERS



EDGE TRIMMERS

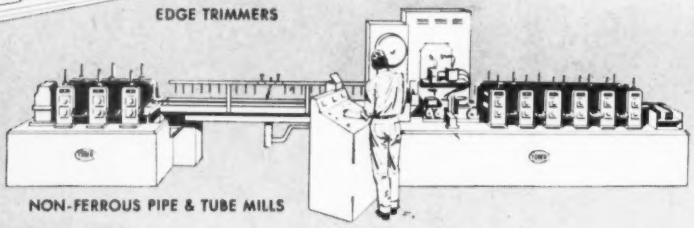
YODER PIPE AND TUBE MILLS

Today's expanding markets and tightening economy demand closer production cost control. YODER'S complete line of ferrous or non-ferrous Pipe and Tube mills can help you meet production schedules economically . . . help you realize significant savings in the manufacture of tube and pipe.

YODER Pipe and Tube mills offer flexible production to meet fluctuating demand. They adapt easily to the most rigorous schedules. Everyday manufacture of constant high quality pipe and tube in diameter of 5/16" to 24". Speeds up to 350 fpm plus can be obtained with YODER mills.

YODER also makes a complete line of Slitting equipment and Cold Roll-Forming machinery. Send for your copy of the fully-descriptive book covering Tube Mill operation.

THE YODER COMPANY
5532 Walworth Ave. • Cleveland 2, Ohio



NON-FERROUS PIPE & TUBE MILLS

ENGINEERING **YODER** MANUFACTURING

PIPE AND TUBE MILLS (ferrous or non-ferrous)
COLD ROLL FORMING MACHINES
ROTARY SLITTING LINES

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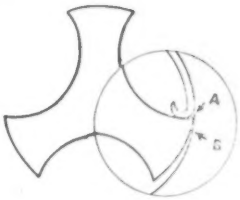
the surface of this "elektraLUBE"® tap is it's own super lubricant



when high pressure at points A and B force out the regular lubricants, "elektraLUBE" is still there to provide permanent lubrication between tap and workpiece.

"elektraLUBE"® Taps are an exclusive SOSSNER development solving the problems of loading and galling by providing supplementary SELF-LUBRICATION.

An "elektraLUBE" Tap has a ductile metal lubricant permanently bonded to its threads and cutting surfaces.

Further information on these and the other quality taps in the Sossner line is available. Write to:

SOSSNER TAP & TOOL CORPORATION

29 BROADWAY • LYNBROOK, L.I., N.Y.

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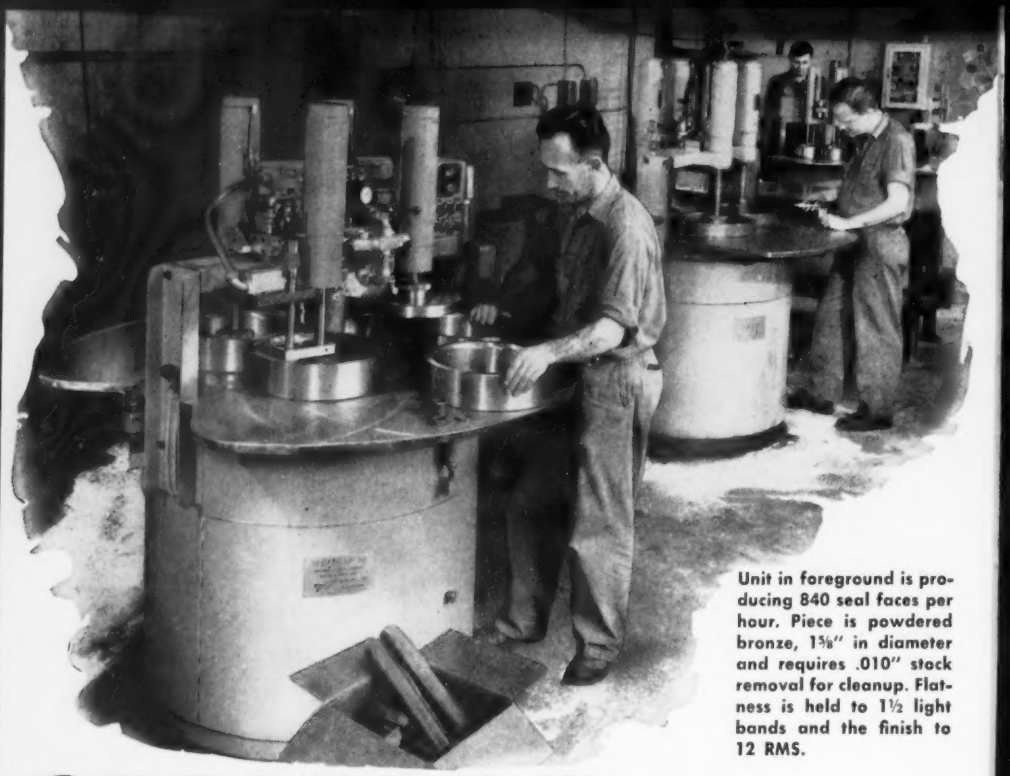


Unit in foreground is producing 840 seal faces per hour. Piece is powdered bronze, 1⅝" in diameter and requires .010" stock removal for cleanup. Flatness is held to 1½ light bands and the finish to 12 RMS.

SPEEDLAP *with . . . . .*

ONE OPERATOR PRODUCING *840 SEAL FACES PER HOUR*

If your production calls for rapid stock removal with high accuracy in size, flatness, parallelism and finish, be sure to check on Speedlap's performance.

These units grind and lap at the same time with micro-inch accuracy. Give you finishes of 1 RMS; flatness and parallelism to 2 millionths of an inch—with tungsten carbides, ceramics, tough alloys or plastics. Best of all they give you LAPPING ACCURACY AT GRINDING PRICES.

Ask for cost and production estimates based on samples of your work. No obligation. Job lapping service also available.

5 *Exclusive* FEATURES

enable a Speedlap to finish jobs better and faster:

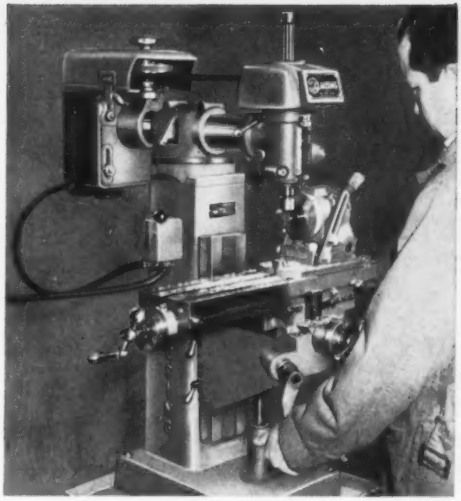
- Water cooled lap base dissipates operational heat to avoid distortion.
- Non-chargeable alloy lap plate assures rapid stock removal.
- Full wear control maintains constant lap flatness.
- Adjustable parts handling stage loads and unloads parts quickly.
- Full pressure air system maintains maximum lapping pressure and automatically raises pressure plates at end of lapping cycle.

ABRADING SYSTEMS COMPANY / 8020 North Monticello Avenue Skokie, Illinois

HERE'S PROOF OF PERFORMANCE . . .

"The Clausing Vertical Miller is the best machine for the money on the market today! It is most versatile . . . and extremely accurate".

— F. L. BALLENTINE, EMPIRE TOOL ENGINEERING COMPANY, INC.



The high precision spindle and drive have 7 ball bearings . . . hardened spindle. Ground and hard chrome plated quill has full length bearing in head.

The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

This report is typical of the experience of users everywhere. The CLAUSING VERTICAL MILLER is a precision machine tool designed for operations where "extremely accurate" machining is required. And, it is an outstanding producer, "most versatile, easiest to set up, get around and operate of *any* miller at or near its low price." Only $875 f.o.b. factory.

VERIFIED ACCURACY— Before it leaves the factory each CLAUSING Mill must pass rigid tolerance tests such as:

1. Top of table perpendicular to column ways within .0005" in 6" travel.
2. T-slots square with cross slide dovetails within .0005".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

MILLS, DRILLS, BORES, REAMS, SHAPES AT ALL ANGLES . . . WITH ONE WORK SET-UP!

Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY

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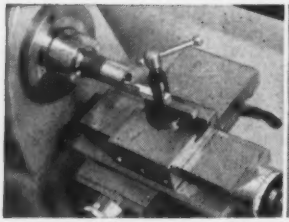
ABRADING SYSTEMS COMPANY / 8020 North Monticello Avenue Skokie, Illinois

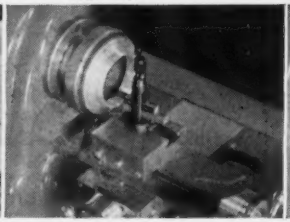
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

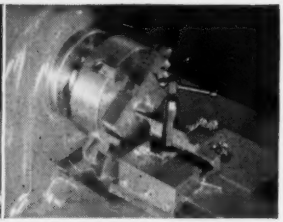
Correct Size - High Speed - Precision Results



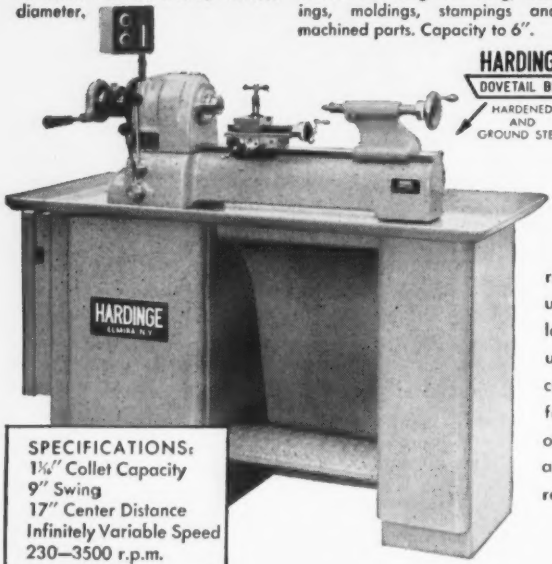
Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".



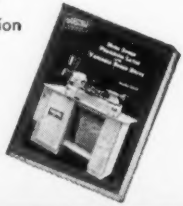
Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".



SPECIFICATIONS:
1⅛" Collet Capacity
9" Swing
17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

The above three important requirements for proper lathe work in tool rooms, production departments, or laboratories are completely fulfilled by the new Hardinge DV59 High Speed Precision Lathe.

Correct size of the machine in relation to work saves loss from under-capacity production on larger lathes. High spindle speeds, up to 3500 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results.



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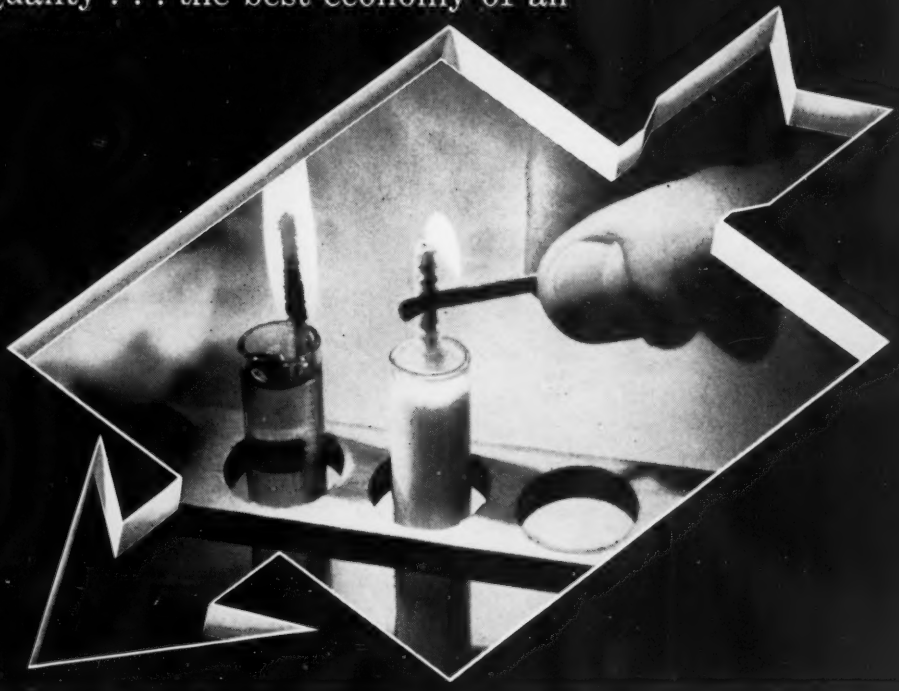
Quality . . . the best economy of all



Another product of Sunoco research . . . a fire-resistant hydraulic fluid

The flame test, above, dramatizes the effectiveness of Sun's new fire-resistant hydraulic fluid. The wick in the conventional fluid burns readily; the wick in Sun's new fluid just can't be lighted.

SUNSAFE, a water-in-oil emulsion, eliminates fire hazards . . . provides increased safety to personnel and equipment. At the same time, operators get the essential performance characteristics of a top-grade hydraulic oil—low rates of wear, long service life, and protection against rust and corrosion.

This combination of *quality* in engineering know-how, and *quality* in product, proves once again that *quality* in any sense is the best economy of all.

For 73 years Sunoco has meant quality right down the line. Today, this quality is found in more than 400 Sunoco industrial products. SUN OIL COMPANY, Phila. 3, Pa., Dept. MM-10 In Canada: Sun Oil Company Limited, Toronto and Montreal.

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

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HONE CORPORATION
DETROIT MICHIGAN

MANUFACTURED BY
JONES-SHIPMAN
LEICESTER, ENGLAND

TOOLROOM GRINDERS

MANY UNUSUAL FEATURES ASSURE HIGH EFFICIENCY

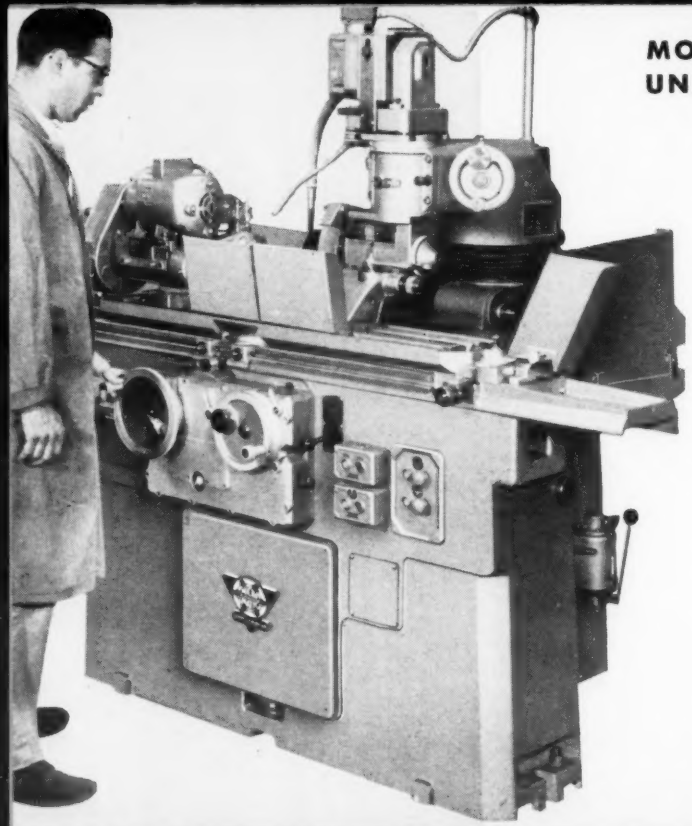
MODEL 310
CUTTER AND TOOL GRINDER

This grinder efficiently performs a wide range of grinding operations. Thus, tools and cutters can be ground in shortest possible time to keep production costs at a minimum.

FEATURES:

Universal operating positions—all within comfortable reach of operator • Anti-friction cross saddle mounting assures sensitive control to cross feed • Table traverses on precision roller chains, giving "fingertip" control • Table dogs reversible—one end spring loaded and the other a dead stop • Table swivels a full 90 degrees in left-hand direction and 45 degrees right-hand • Large diameter wheel spindle, mounted on specially selected preloaded bearings • Universal Cutter Head adjustable to swing from 8″ to 12″ diameters • Cutter Head and Tailstock provided with clearance angle setting adjustments.

For additional information, write for Micromatic Bulletin 139W.



MODEL 1014
UNIVERSAL TOOLROOM GRINDER

This 1014 Universal Tool Room Grinder is designed to give extraordinary sensitive control that results in *high quality external and internal grinding.*

Wheelhead has deep throat capacity and wheel position is centralized in relation to table. This permits surface grinding and offers special facilities for broach grinding.

The extra Universal Cutterhead extends the versatility of this highly accurate machine to cover tool and cutter grinding.

FEATURES:

Hand cross feed and vertical feed in .0001″ increments • Auto cross feed per reversal of table of .0001″ to .007″ over .025″ (reduction in work diameter of .050″) • Automatic table traverse, 4 speeds provided. Micrometer adjustment to table traverse in .001″ divisions • Wheelhead saddle on anti-friction mountings • Precision built wheelhead motor on anti-vibration mountings • Wheel spindle unit swivels full 360° • Five external grinding wheel speeds • Grinding wheels fitted on either end of wheel spindle. Nitralloy spindle runs in plain bearings • Vernier scales to wheelhead and table swivels • Fast cross traverse to wheelhead for setting purposes.

For additional information, send for Micromatic Bulletin 206Q.

For more data circle 392 on Postpaid Card

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

PRECISION PRODUCTION THROUGH MICROHONING

MICRO MATIC

MAKERS OF FAMOUS CUSTOM-BLENDED BRAKE SHOE LININGS

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Assures You Precision to the Finest Degree to Meet Your Requirements —Backed by the Name Supreme in the World of Measurement

GAGE BLOCKS

(JOHANSSON) and accessories. Short deliveries. Inspection and reconditioning service available at our plant.

INTERNAL INDICATORS

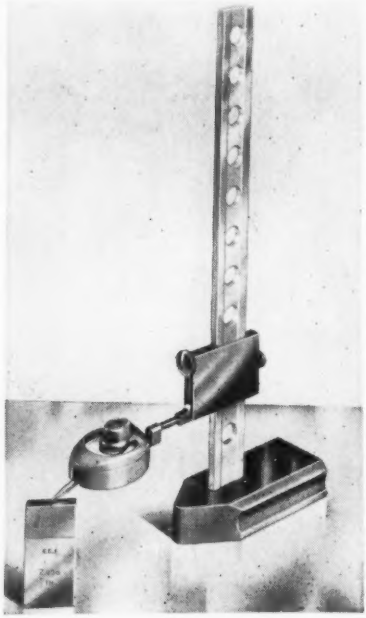
(for inside measurements .155 to 24 inches). Scale range plus or minus .001 graduated to .0001 and minus .020 graduated to .0001.

MIKROKATOR

(Amplifier—for outside measurements) Graduations .0001 to .000001 or .01M to .0002M.

OTHER JOHANSSON PRODUCTS

Micrometers, Snap Gages, Extensometers, Dynamometers, Hardness Testers, Surface Finish Indicators, Interferometers, Plugs, Rings and Special Gages.



MINIKATOR
with height gage

The Minikator No. 590 is a micro-indicator especially designed for transferring dimensions and measuring in otherwise inaccessible places. The instrument is particularly suitable for indicating out-of-roundness or concentricity of grinding machine spindles and for locating drilling jigs.

The amplification device of the Minikator is based on the Mikrokator Principle, it is purely mechanical and without friction and slackness. Measuring points of two different lengths $^1/_{16}$" diameter are supplied with every instrument. One point provides a measurement range of .003" (0.08 mm) with .00005" (0.001 mm) dial graduations and the other provides a range of .006" (0.16 mm) with .0001" (0.002 mm) dial graduations.

Write for Literature

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A DIVISION OF SWEDISH GAGE CO.

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DESIGN
PRECISION
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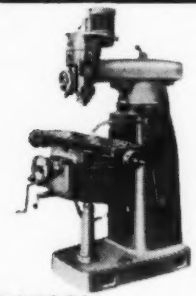

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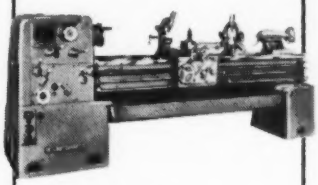
1½ H.P. Vertical Miller
$1600.00



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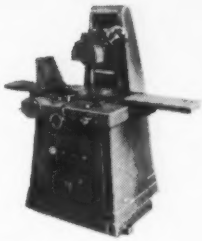
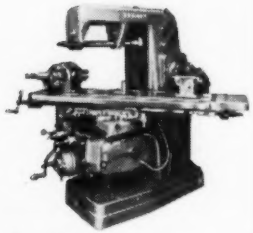
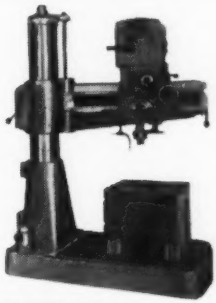
14/19" x 40" **$2380.00**
16/21" x 60" **$2985.00**
up to 32/42" x 144"



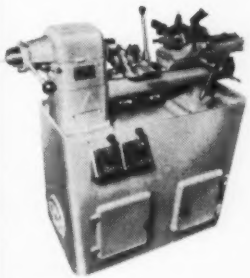
ASTRA
Hydraulic Surface Grinder
from **$2100.00**
up to 12" x 48"



#2, 3 & 4
GRAHAM
Universal or Vertical Millers
from **$3780.00**



NEWBOLD
Radial Drill from **$2400.00**



SECOP
Second Operation Lathe
V-Bed **$1575.00**

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INQUIRE ABOUT RENTALS —
NO DEPOSIT — WITH FINAL OWNERSHIP

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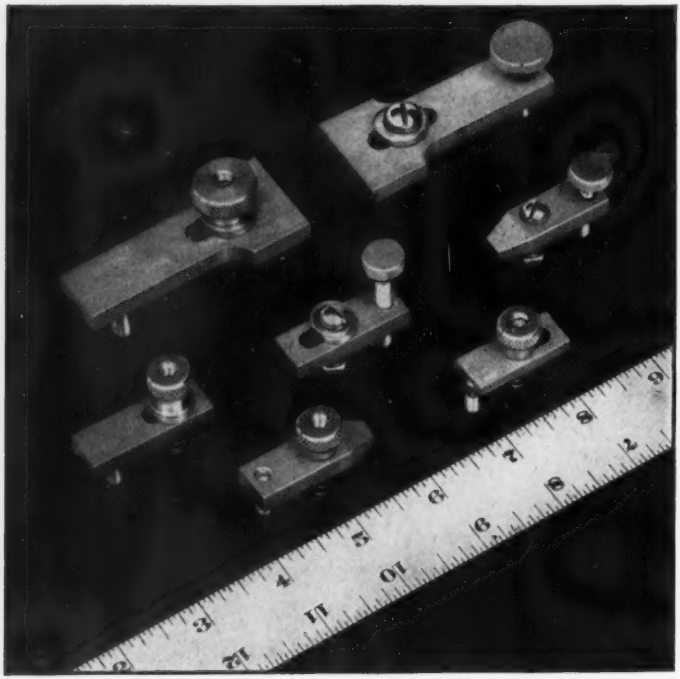

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- Tensile strength 90,000 p.s.i.
- Heat resistant—austenitic series (not affected by heat treatment with high resistance to scaling and distortion)
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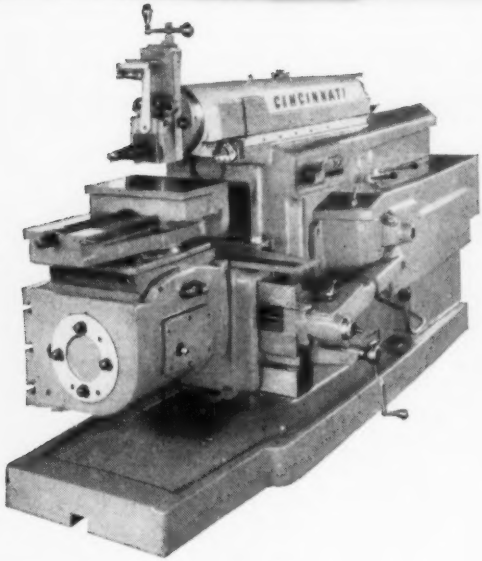

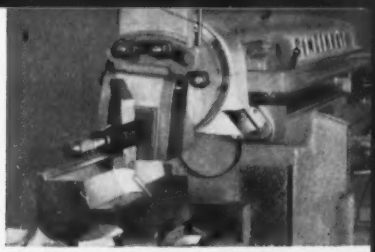

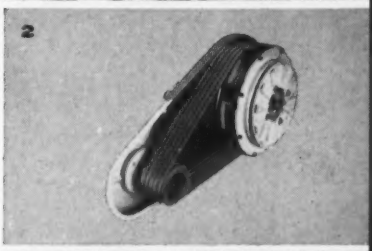

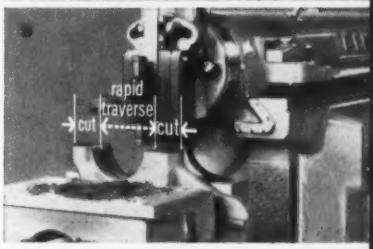

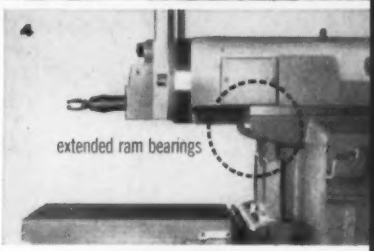

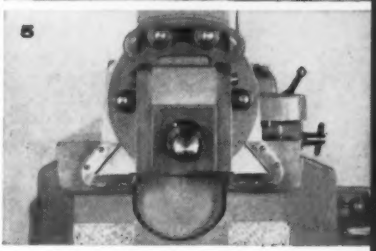

Cincinnati® standard features: extra savings at no extra cost

Cincinnati Shapers give you so many money-saving features per dollar invested that they can be the most profitable equipment in your shop.

1. This 2" cut, .030" feed, demonstrates the ability of the 50 psi automatic lubrication system to maintain oil films under heavy loads.

2. Brushless electromagnetic brake and clutch insure fast easy operation. No adjustment is required.

3. Both vertical and horizontal rapid traverse are standard Cincinnati features which substantially reduce setup and cutting time.

4. Extended ramway bearings increase ram support and minimize wear. Full table clearance to the column gets work closer to the column, minimizes overhang.

5. The vee ramways are integrally cast with the column. Ramway rigidity is increased by eliminating joints. Full length tapered gib provides for easy adjustment, maintains accuracy.

Write Dept. **G** for Bulletin "Cincinnati Rigid Shapers."

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO. Cincinnati 11, Ohio

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New! AIR CONTROL UNITS

Automatically

- ★ Filter pressurized air to provide a clean, dry air supply
- ★ Compensate for fluctuations in air pressure delivered by the air supply system
- ★ Compensate for variations in cfm requirements of pneumatic equipment
- ★ Adjust amount of misted lubricant to meet changing cycle rates or surge demands

The new Bellows Lubri-Air® Control Unit

T.M. Registered Pat. Pending

● This new Lubri-Air Control Unit, made by The Bellows Co., and sold and serviced by Bellows and Valvair Corporation Field Engineers, is a major break through to the problem of supplying clean, dry, pressure-regulated and properly lubricated air to pneumatic equipment.

The Bellows Lubri-Air Control Unit, once set to match the needs of the equipment it serves, automatically removes dirt and moisture from the air stream, maintains a constant down stream pressure regardless of fluctuations in supply pressure or in cfm requirements, and feeds a correct amount of misted oil to the air stream regardless of variations in the air flow rate.

Bellows Lubri-Air Control Units assure continuous top working efficiency as well as maximum long life with minimum maintenance from air-powered equipment.

Available for immediate delivery in the ¼", ⅜" and ½" sizes. ¾" and 1" sizes shortly.

See your Bellows-Valvair Field Engineer or write direct to Dept. MMS 1059, The Bellows Co., Akron 9, Ohio, for descriptive Bulletin LA-15.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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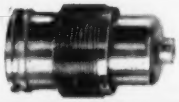
Start saving money right now on threading jobs like these

SINK FLANGE - STAINLESS
3.341 IN. DIA. - 10 TPI
THREADING TIME - 37 SECONDS

STUD - TITANIUM
.25 IN. DIA. - 28 TPI
THREADING TIME - 20 SECONDS

FOCUSING NUT - ALUMINUM
1 IN. DIA. - 16 TPI 6 START
THREADING TIME - 25 SECONDS



BODY - STAINLESS STEEL
1.25 IN. DIA. - 24 TPI
THREADING TIME - 7 SECONDS

WORM - MILD STEEL
.9563 IN. DIA. 26 D.P. - 8 START
THREADING TIME - 3 MIN.-20 SECS.

VALVE STEM - BRASS
2 START 10 TPI STUB ACME
THREADING TIME - 23 SECONDS

SCROLL - A.I.S.I. 4150
.500 LEAD
THREADING TIME - 6 MIN. 13 SECS.

ADAPTOR - ZINC ALLOY
11 TPI INT. 16 TPI EXT. SIMULTANEOUS
THREADING TIME - 12 SECONDS

FUEL NOZZLE - AMS-5640
1.040 IN. DIA. - 12 TPI
THREADING TIME - 12 SECONDS

WITH CRI-DAN THREADING LATHES

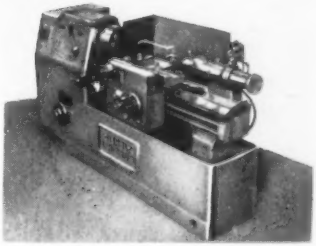
. . . cut costs with simple single-point carbide tools. Eliminate expense of thread milling cutters or thread grinding wheels.

. . . assure extremely accurate lead and thread form and exceptional finish on materials that don't allow economical threading by other methods.

. . . handle any material from titanium or toughest alloy steels to brass and other non-ferrous metals with a wide selection of spindle speeds and feeds to meet all job requirements.

. . . set up fast to produce single- or multiple-start, coarse or fine, left- or right-hand threads, parallel or tapered with metric or inch pitches — thread up to shoulders on all types of internal and external operations.

Why put off the savings the CRI-DAN method can bring you *right now*? Ask your Gisholt Representative for complete details. Or write us for literature or cost estimates on your particular work.



Two models are available. The smaller Model 8 is shown. Rugged saddle supports fast-acting threading slide, easily positioned along bed. Complete change-over from job to job can be made in 15 minutes.

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Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

Factory-Rebuilt Machines with New-Machine Guarantee

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes

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BIG! RUGGED! VERSATILE!

Every inch a "Light-Heavyweight" . . .

New

WT
ALKER-TURNER

20″ Variable Speed BAND SAW

With its massive construction and many other outstanding features, this new Walker-Turner 20″ Band Saw is a natural for heavy duty production work. Its variable speed drive permits dialing any speed from 50 to 4500 fpm—*while the machine is running*—for fast, efficient cutting of metals (even tough steel), wood, or plastics. Its big, heavily-ribbed tilting table rests on widely-spaced front and back trunnions and has an additional side brace. And, like the popular W-T 16″ Band Saw, this new "Light-Heavyweight" has safe, accurate guides that support the blade down to the work; solid bar upper guide post; and rugged ball bearing thrust support.

Your W-T dealer will be glad to give you details. He's listed under "Tools" in your classified telephone directory.

FREE CATALOG

Write to Walker-Turner Division, Rockwell Manufacturing Company, Dept. WK-22, 400 N. Lexington Ave., Pittsburgh 8, Pa.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

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431 Main St. Cincinnati 2, Ohio

Fred W. Vogel

Over the Editor's Desk

WAY OF LIFE

In a recent speech entitled "The Need for Excellence" by Gilbert W. Chapman, the illustrious president of The Yale & Towne Manufacturing Company expresses a thought that may well be remembered when the going gets rough or inspiration is needed to understand the background of daily events. He had this to say: "America is many things to many people. For some, it is a town where everybody owns a home, an automobile, a washing machine, and a television set. It's a population on wheels, moving in all directions, for fun and relaxation. For some, America is a fertile farmland; for others, cities teeming with industry. America is football and baseball in every town, and symphony orchestras and public libraries and art museums in every city. It is the strongest and richest nation in the world. America is generous and courageous. It is all this—and very much more. Fundamentally, America is an ideal. It came into being for an ideal, and in all its history, in war and in peace, we have lived by an ideal."

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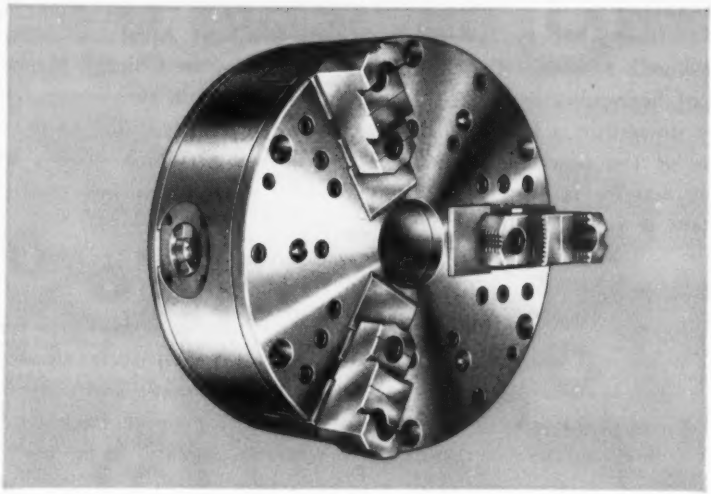
HOME STRETCH

In many business establishments, the last three months of a year traditionally are considered the most significant—the three months during which an attempt is made to make up losses if losses were sustained during earlier months, three months for assessing progress, three months for planning for the coming new year. When attention is focused on metalworking, certainly we cannot overlook the effects of the steel strike which, at the time of our going to press with this issue, is making deep inroads into more and more inventories and production schedules. Any type of planning for current as well as long range operations must take into account what the settlement

THE FIRST MAJOR CHUCK DEVELOPMENT IN FIFTY YEARS



• This radically different chuck combines all the desirable features of hand and power chucks. It has accuracy within .001 TIR, repeatability within .0005 TIR, unequalled gripping power, and no size limitation.

This major chuck development is a principle utilizing combination of pinion, gear plate, screw and wedge. The lug-type pinion is turned manually or by a power wrench. A pinion engages the gear plate causing the screw to move the wedge. The action of the screw on the wedge controls the chuck jaws. The force of the wedge on the jaws holds the work with tremendous power.

In addition to this unique, new principle, this chuck offers such features as over-tightening protection, operator protection, higher speeds, center-hole chucking and many more. For details, write us at the address below, Department 569.

THE CREST OF QUALITY

SKINNER CHUCKS

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT

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of the strike will mean in terms of "catching-up." Many production executives are beginning to think about the Expositions which will take place next year and the opportunities that they will afford for seeing first hand the progress that is being made in metalworking equipment and methods. It is not too early to start planning to be in attendance at the ASTE Tool Show at the Detroit Artillery Armory during the week of April 21, 1960, or at the National Machine Tool Builder's Exposition in Chicago during the weeks of September 6 and September 12, 1960. These two events, coming as they do within a few months of each other, are designed to provide a glimpse of the newest and best, during a year in which a high rate of business activity is anticipated. The months during this last quarter are important if you will make them so.

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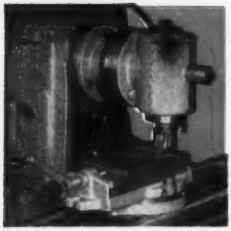
EXTRA TEN

The duties of Glenn Moore, Dealer and Export Sales Manager for The Heald Machine Company, require that he travel extensively all over the world and as a consequence, he has been able to observe and compare the economy and philosophy of a variety of lands and peoples. Recently Glenn returned from an extended trip to Japan where he was able to put his powers of observation to good use. This was demonstrated in a talk that he gave several times to groups of management and supervision.

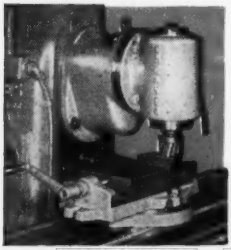
We feel indebted to Samuel W. Baker of Burson-Marsteller Associates, Inc. and Phil Warren of Heald Machine Company for sending us the following item about Glenn Moore which appeared in "Heald Craftsman."

Foresaking his usual geniality, Glenn was dead serious. He pointed out from actual case histories how we suffer by comparison with the present-day attitude of the Japanese. The remarkable lifting themselves-by-their-bootstraps operation in Hiroshima, the reversal of a $500,000,000 trade deficit to a $500,000,000 surplus in just this last year, the willingness to work painstakingly and cheerfully for long hours at low pay are clearly spelled out in Glenn's authoritative report. Glenn related their efforts to economic competition and its effect on our product; but he went much further than that—he showed how attitude alone can spell the difference between future success and failure for each of us—all over this country.

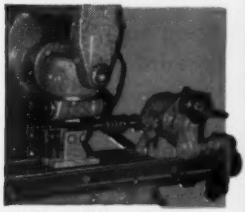
We've all seen it—the indifferent automobile salesman, the bored store clerk, the sloppy workman, the careless attendant. We can see it in our customer magazine advertisements—everything must be "quick," "easy" or



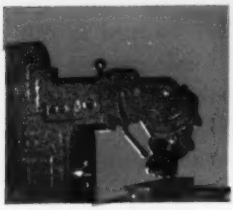
Heavy Duty Vertical Milling Attachment



Heavy Duty Offset Vertical Milling Attachment



Universal Milling Attachment



Toolmakers Overarm

Heavy duty attachments increase versatility of dependable, low-cost

GREAVES MILLS

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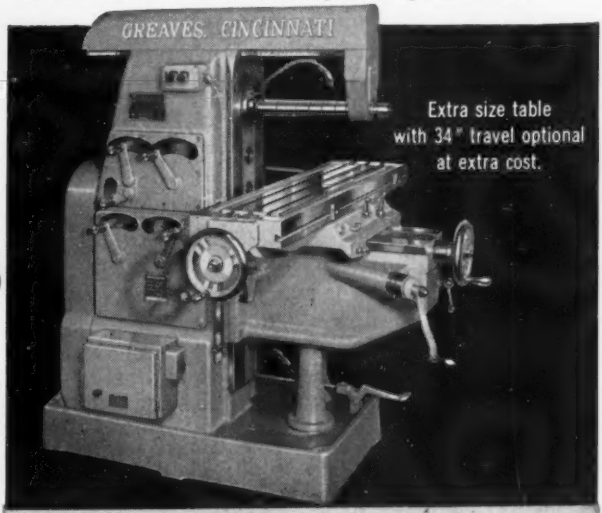

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"foolproof." No importance or emphasis is placed on individual effort or quality of painstaking performance. We're spawning a generation of mediocrity whose high school textbooks must carry such titles as "Mathematics can be Fun" to appeal to the laziest, least energetic in the class.

Now no one, least of all Glenn, expects us to trade our high standard of living for the present-day life of the Japanese. But our heritage of comfort and convenience must be eternally earned. This becomes stark truth in the light of comparisons on an economic level. If we face up to facts we have no choice but to change our thinking—improve our attitude.

Nor is anyone asking us directly to produce more in the same time—the solution lies in quality. It's not so much a case of working harder as it is a case of working smarter. Such activity will, of course, as a natural result improve our productive capacity, reduce scrap and eliminate errors, but the emphasis is on quality—on doing one's job better in the same amount of time.

Glenn's recommendations were clear. He suggests three avenues of approach to the problem. The first two involve mutual respect—placing oneself in another's position and second, avoiding damaging and senseless criticism of others shortcomings—real or imagined. The third point, one to which Glenn has given considerable thought and from which we have gleaned the title of this editorial "The Extra Ten," is perhaps best reported in Glenn's own words.

"I am convinced there is not a person in this Company, starting with myself, who couldn't produce 10 percent more than he is now producing, without asking for 10 percent more in return for himself. Have faith that there will be something gained from this. Have you ever stopped to think how much we are talking about? We are talking about 6 minutes out of 60 minutes. We are talking about the length of time it takes to discuss how your tomatoes are growing, what you did last week end, what you plan to do next week end, or the trouble you have had with your car. I am sure that this extra 10 percent will never hurt one of us. I know in all probability we will go home at the end of the day with a greater feeling of satisfaction than we may have now."

This "Extra Ten" that Glenn speaks of is not just Heald maroon and grey, it's Red, White and Blue. To ignore his advice is frankly unpatriotic.

Unfortunately, this apathy is country-wide and the Machine Tool Industry is no exception. The miracle of change is not an overnight job but let's be leaders as an Industry in pointing the way for all true Americans.

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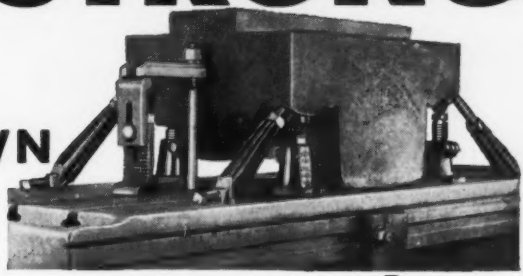

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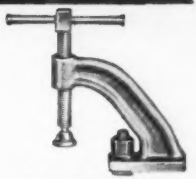

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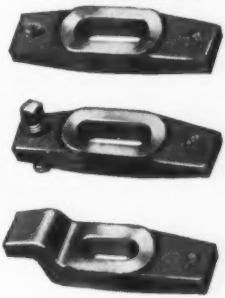

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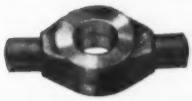

STRAP CLAMPS

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Machining Parts for Space Vehicles

Fig. 1—Machining a compressor wheel for a P & W jet engine, using a Monarch T-lathe.

Pratt & Whitney's Florida Research Center develops, builds and tests jet and rocket engines.

By HOWARD CAMPBELL
Editor Emeritus, Modern Machine Shop

In recent years it has become more and more apparent to the United Aircraft Corporation that its Pratt & Whitney Aircraft Plant, in East Hartford, Connecticut could not accommodate further facilities. Inasmuch as a research and development center was already being planned, it was necessary to find a new site where more room would be available and which would afford the necessary isolation for jet engine testing—which is noisy.

After considering all parts of the country, a remote site was selected some twenty miles west of Palm Beach, Florida. Here, on a 7,000-acre plot, Pratt & Whitney Aircraft has built a plant that contains 650,000 square feet which houses

Fig. 2—Operator of P & W jig borer is shown boring holes in flange of jet engine housing.

Fig. 3—Operator uses a Cincinnati Hydro-Tel milling machine to mill three different dimensions on an air-foil for a jet engine.

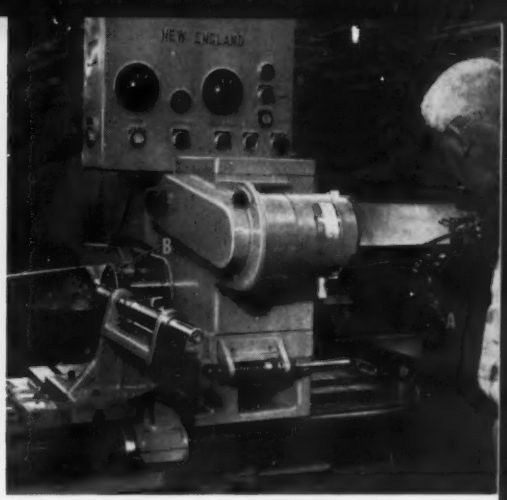

Fig. 4—Milling an arc in an air-foil using a New England air-foil miller equipped wi.h a pattern electronic spark gap tracer.

the manufacturing departments and offices. On the same piece of ground, but far enough away from the plant so that the noise of engines under test presents no problems, is a set of four test stands where the jet engines are tested.

In total, the company has developed some 1,000 acres as test areas, including large rocket engine testing facilities for the development of a liquid hydrogen-fueled rocket engine.

In addition to the machine shop, which includes 526 machine tools, the main building also houses the welding department, with 47 welding machines, a drop hammer section with 12 pieces of equipment, a heat treat department in which are located a total of 32 furnaces and other pieces of equipment, and a plating department with a total of 76 tanks.

The plant facilities include a cafeteria equipped with the latest in kitchen and serving equipment, a laboratory for making the necessary metallurgical and chemical tests, and a dispensary.

The Florida plant is not a production plant; the facilities there are devoted entirely to the development, building and testing of new jet and rocket engines for aircraft and space vehicles. The operation provides employment for more than 2,000 people, of which about half are engineers, scientists, and skilled technicians.

The two major projects at the Center are the J-58 turbojet engine —an engine in the 30,000-pound thrust class designed for speeds three times that of sound, and the XLR rocket engine, which is an upper-stage engine which utilizes liquid hydrogen. The rocket engine has been selected to power the Convair Centaur space vehicle, which will be the second stage of a modified Atlas missile. Centaur will also serve as the third stage of the Saturn—a huge space vehicle which is planned for the near future.

Inasmuch as there has been no

great demand in Florida for draftsmen, welders, sheet metal workers, or machinists who were experienced in the working of the new metals and alloys employed in the manufacture of jet engines, it was necessary to set up a training school, which has become a department of the plant.

The machine shop equipment includes the very latest in machine tools and metal-working devices, such as the Monarch T-Lathe shown in Fig. 1. Here an operator is shown in process of contour turning, facing and grooving a compressor wheel for a jet engine.

The piece, which is of Waspaloy (steel), is held in a chuck and the operations are performed with Carboloy tools. This machine is of especially sturdy construction, ideal for machining pieces of short length and large diameter. Taking a cut of 0.040 inch on a side with a feed of 0.008 to 0.010 inch while operating at a cutting speed of 150 feet per minute, the limit of plus or minus 0.001 inch is easily held.

In Fig. 2 a Pratt & Whitney jig-boring machine is shown in process of boring the holes in the flange of a jet engine housing section so that the section can be assembled to the engine. A machine of this type, designed especially for tool work, is necessary in order to obtain the required accuracy. Using a carbide boring tool, the holes are bored to within 0.0002 inch of drawing specifications. The maximum cumulative tolerance between hole centers is 0.001 inch.

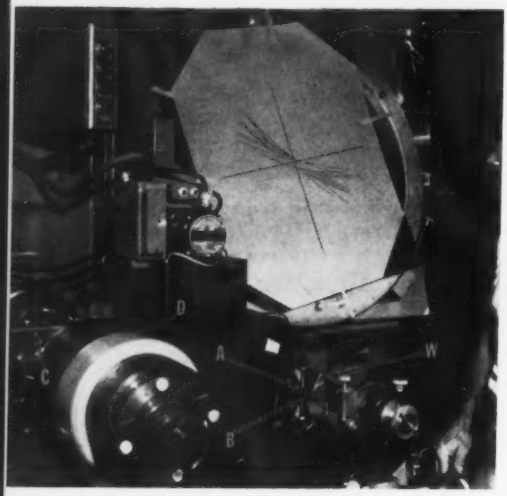

Fig. 5—The contour of the finished air-foil is checked with engineering drawings in J & L comparator, shown in this illustration.

The operation of milling three dimensions on an air-foil is shown in Fig. 3. In anticipation of need for a number of these pieces, a pattern was made and the operation is performed in a Cincinnati 4-spindle 3-dimension Hydro-Tel milling machine in which a follower, in contact with the pattern, controls and guides movement of the tool.

The pattern and workpiece are held in identical fixtures, and the cutting tool is an end mill. A dial indicator aids in maintaining the accuracy. The tolerance on this operation is 0.004 inch.

Another milling operation is shown in process in Fig. 4. For this operation a New England air-foil milling machine is used, employing a milling cutter of the exact diameter necessary to produce the correct

Fig. 6—Using 12 cassettes, operator is shown here X-raying circular weld in workpiece.

arc in the workpiece. The movement of the cutter, indicated at *A*, is controlled by the circular follower, *B*, which was made to drawing specifications.

The follower, called an "electronic spark gap tracer," is not in contact with the pattern; an electronic control maintains a gap of 0.0015 inch between the surface of the pattern and the periphery of the follower. The surface of the piece is machined to within 0.004 inch of specifications. With this machine and the original pattern, all other masters are made for use on other air-foil machining operations.

The air-foil, while of intricate design, is a very important part in the assembly of a jet engine. When the surfaces of the air-foil have been machined, the piece is checked for accuracy by the use of the J & L comparator shown in operation in Fig. 5. Here the workpiece, indicated at *W*, is swung between centers and the contact points *A* and *B* are moved into contact with the contour to be inspected.

The slightest movement of the points *A* and *B* is duplicated by identical points in the housing *C*, and a beam of light from the head D, projected against the points in the housing, is reflected on the screen. With the tracing of the required contour mounted on the screen, as shown, the relation of the contour of the actual workpiece to the engineering specifications is clearly seen.

The part shown set up for X-ray

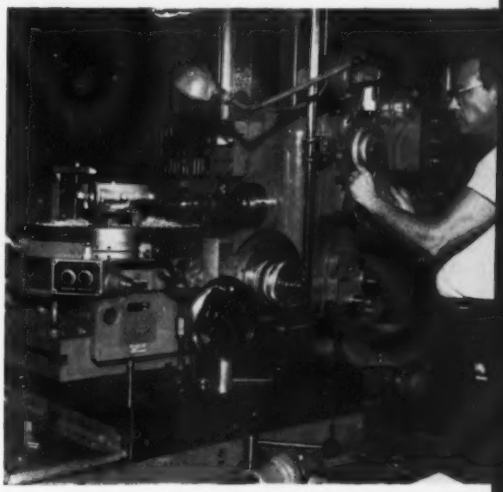

Fig. 7—Machining a part for a jet engine. The extreme accuracy required is obtained by using a DeVlieg Jig-Mil for the operation.

". . . operator steps outside lead-lined room and applies current."

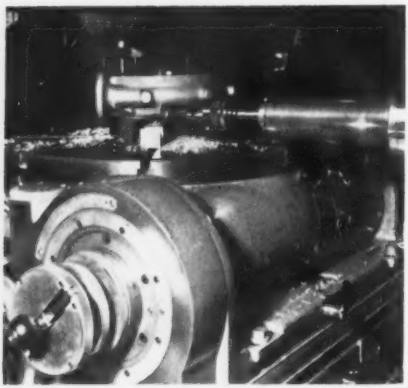

Fig. 8—Close-up view of a boring operation being performed on a jet engine part.

inspection in Fig. 6 is a steel band, made by welding two bands together. The operator has circled the workpiece with 12 cassettes holding the X-ray films and has locked them together by the use of adhesive tape. The machine is a Norelco unit equipped with a 150 kva. detachable head. With the cassettes in place and the head in central position, the operator steps outside the lead-lined room and then he applies the current.

The head is designed to cover only a small section of the workpiece at a time. As each head is exposed, the operator enters and, by means of the control unit shown in his hand, revolves the head to the succeeding position, and thus on around the band. The locations of the cassettes are numbered, and any defect in the weld becomes apparent when the film is developed.

The machining of a jet engine part of classified design, of classified material is shown in process in Fig. 7. The machine is a DeVlieg Jig-Mil, equipped with a circular table upon which the workpiece is centrally mounted. In this illustration the drilling operation is shown preparatory to boring. In Fig. 8 the boring operation is shown. This operation is held to a tolerance of 0.0002 inch.

Inasmuch as the several operations on this piece are held within close limits to each other, the piece must be processed in a machine that

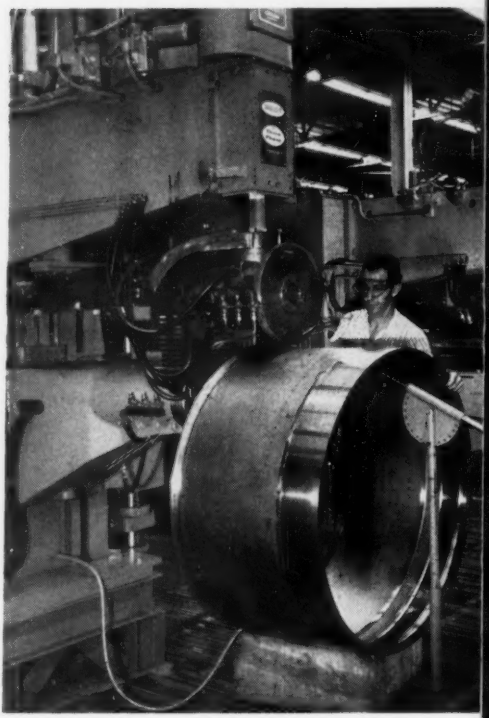

Fig. 9—Setup for seam-welding the stainless steel components of a jet engine housing.

can be depended upon for the extreme accuracy required.

The illustration Fig. 9 shows the operation of seam-welding the component parts of a jet engine housing, using a Sciaky welding machine. The material is stainless steel. The housing appears to be resting on a box; actually it is not, but is hung on a roller that extends out from the machine as indicated by the arrow. The operator guides the piece by hand as it revolves in contact with the welding head.

★ modern machine shop ★

Revised Tap Standards. The latest revision of the American Standard on cut and ground thread taps, incorporating the complete revision of tap standards instituted by the tap manufacturers in 1955, has been approved by the American Standards Association and published by The American Society of Mechanical Engineers. Titled "American Standard Taps — Cut and Ground Threads, B5.4-1959," the new publication includes tap styles, nomenclature and definitions, thread series data, a standard system of marking, and dimensional and tolerance tables for right hand thread taps of the following types: hand, machine screw, spiral pointed, helical (spiral) fluted, tapper, nut, pulley and pipe.

The present revision, a 48-page publication illustrated with diagrams and charts, includes prevailing industry changes and corrections through 1957. The standard comes under the 1948 American-British-Canadian Declaration of Accord on unification of screw threads, which provided for general interchangeability of threaded products made in accordance with the standards of the three nations.

The American Standard Taps—Cut and Ground Threads, B5.4-1959, is available at $2.50 a copy from the American Standards Association, 70 E. 45th St., New York 17, N. Y., or from The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

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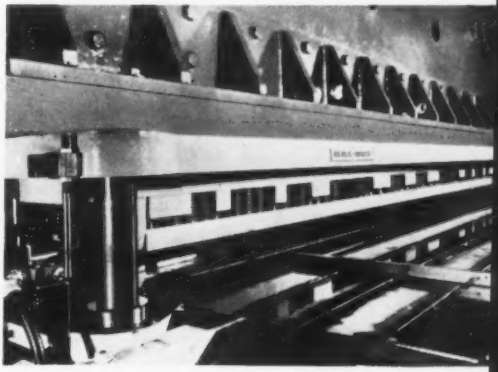
Giant Die Set

Use of a press brake for piercing and forming operations is made possible by the giant die set shown herewith, one of the largest ever manufactured by the E. W. Bliss Company. The die set, 138 inches long, 28 inches wide and a total of 10½ inches thick, is now being used by the Food Machinery and Chemical Corporation, Riverside, California, in a press brake operation which pierces and forms channels from flat stock for subsequent use as conveyor side rails.



Close-up view of huge press brake die set.

LET AN AUTHORITY TELL YOU

How to Solve Your Supervisory Problems

By ALFRED M. COOPER
Contributing Editor, Modern Machine Shop

A query from an executive of the A. Rowley Tool & Engineering Company, of Green Lake, Wisconsin, emphasizes the importance today of giving thought to an employee's seniority rights. In the development of personnel policy it is essential that these length-of-service privileges be carefully set forth, and thereafter publicized to the employees.

Since seniority rights may be closely tied in with pay increases, job tenure, and retirement benefits, it is essential that both management and employee know exactly what constitutes the *perquisites and limitations* of seniority rights, right from the date of employment.

Those of us who are old enough can remember when such rights existed only in the mind of the employer and were subject to revision in terms of whim or personality conflict. Today, those who have not kept abreast of the situation might assume that seniority rights were uniformly equitable throughout industry and enforced as a matter of course.

One reason for this belief is that modern personnel policy in industry tends to follow practices in effect under governmental civil service. There is basis for the belief that this constitutes enlightened thinking, but, as I will illustrate, job security even under federal employment may be far less an actuality than is generally assumed.

The question also must be considered as to the actual degree that hard-and-fast seniority rights and job security are advisable under private enterprise.

Going back a number of years, I remember being employed by a great plant which had 45,000 people on the payroll. These employees had gradually increased in number through two decades of prosperity and, as results proved, not too much thought was given to the actual duties of each new employee or the need for adding him (or her) to the payroll. A department head simply

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felt that any increase in production schedules necessitated hiring a number of new workers. And it was axiomatic in that plant that it was almost impossible to get fired, or even laid off, so long as you punched the time-clock at 8 o'clock and at quitting time.

Then, all of a sudden, disaster struck. Management discovered that costs had risen astronomically, while demand had dropped off a bit. Thereafter, the 45,000 work force was whittled down, *within a period of three weeks,* to an all-time low of 18,000. And the retrenchment order was accompanied by the flat dictum to foremen: Get rid of your dead wood first; thereafter cut the force *in terms of ability to produce.*

Those of us who survived the cataclysm suddenly realized that play-time was over. The result of this wave of fear-of-loss-of-job was dramatic. That is, the plant continued to get out the identical production quota with the 18,000 that it had with 45,000 employees. And I was never able to discover that any of those who missed the axe were working much harder than they had in preceding years.

Seniority, job tenure, job security —call it what you will—has always been the keystone of governmental or civil service personnel policy. In instances, when methods of selection and day-by-day supervision are good, this feature works satisfactorily. Yet there can be no question but that seniority as the decisive factor in job retention *or promotion* can develop a weak organization. The so-called "merit system," when administered by a group of politically appointed civil service commissioners, can degenerate into a travesty in which any supervisor who recommends an inefficient employee for dismissal may find himself on trial before this commission for persecution of a subordinate.

The proof that seniority under the merit system may be misleading is found when the time comes to select a new governmental supervisor. Then seniority is forgotten, and every effort is made to select the best man regardless of length of service.

In years past I have known men in private industry who were casually discharged without cause when they had completed 29 of 30 years of service necessary for retirement with pay. More recently, I have known of a city civil service commission *selling police lieutenancies* for $300 each, cash on the barrelhead before sergeants took a perfunctory promotional examination.

But the most remarkable instance of breakdown I have witnessed in civil service administration occurred but last week, in the post office of the small city in which I live. Here two employees under federal civil service were discharged without a hearing, each of whom had 14 years of service and hoped to retire a year later on a reduced (15-year) pension.

All of the foregoing incidents in private and public employment came to my attention only incidentally, after working for many years under both private enterprise and governmental employment. They are not conclusive, but have served to make me reluctant to recommend that primary emphasis be placed on seniority as a means of determining matters relating either to promotion or pay increases in private industry.

HOW TO DESIGN A

HOT Platen for

The techniques discussed are intended to solve those problems most frequently encountered in designing equipment for mass producing bonded parts.

By WILLIAM P. ENGLER
Tool Engineer, Advanced Methods Research,
Long Beach Division, Douglas Aircraft Company

With metal bonding finding ever increasing use in the fabrication of critical sheet metal assemblies, a big problem faced in most shops doing this kind of work is how to mass produce bonded parts while keeping bonding process pressures and temperatures within the critical tolerances required for optimum results. Currently, most bonded parts are being produced in individual tools, specifically designed for the part in question, and which position and hold the part components in place during bonding. But as production goes up, designing and building a special tool for each part becomes very costly, and then loading these individual tools and placing them in an autoclave for bonding becomes a time-consuming process.

At the Long Beach, California Division of Douglas Aircraft Company, where hundreds of metal bonded parts are being produced for the C-133 military cargo airplane and the huge, new DC-8 jetliner transport, engineers decided that all flat bonded assemblies could be mass produced on a single huge hot platen, thereby eliminating the need for individual tools and making it possible to load and bond a number of parts in a single operation. The tools required for this consolidated bonding technique would be a steam-heated hot platen 6 feet by 18 feet in area, an autoclave large enough to contain the platen during bonding, and a method for handling the platen from and to the autoclave during the loading portion of the cycle.

Designing, building and installing the autoclave and handling equipment was a relatively routine procedure. Designing the hot platen and its associated heating and control equipment was a task of different caliber.

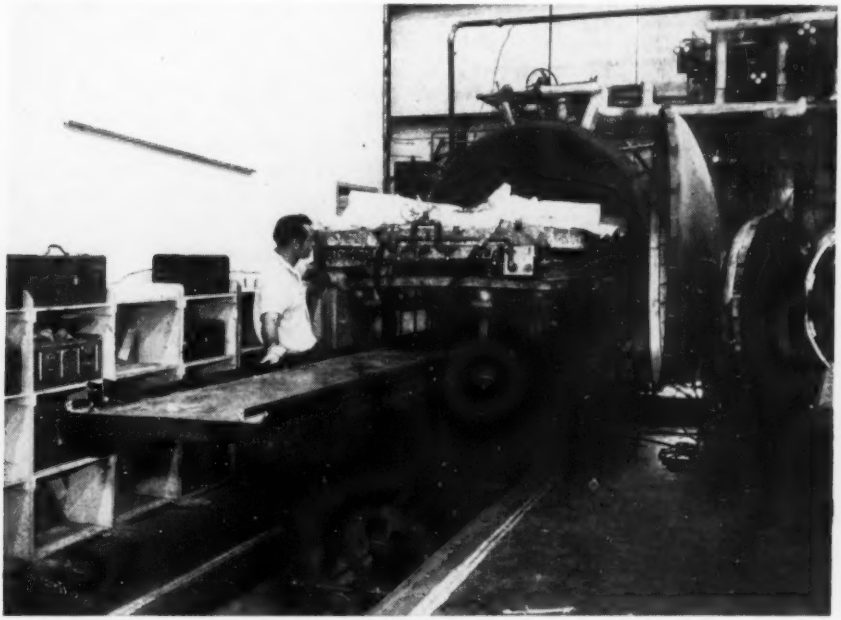
The major problems involved in platen design were: (1) the ability to raise the entire platen evenly to the proper bonding temperature without a variance of more than

Metal BONDING

plus-or-minus 5 degrees F. on any portion of its surface; (2) maintaining the platen at 305 degrees F., plus-or-minus 5 degrees F. throughout the bonding cycle; (3) the installation of automatically controlled steam valve equipment sensitive enough to meet the critical temperature requirements; and (4) the installation of steam traps sufficiently sensitive and sufficiently reliable to assure even heating at all times.

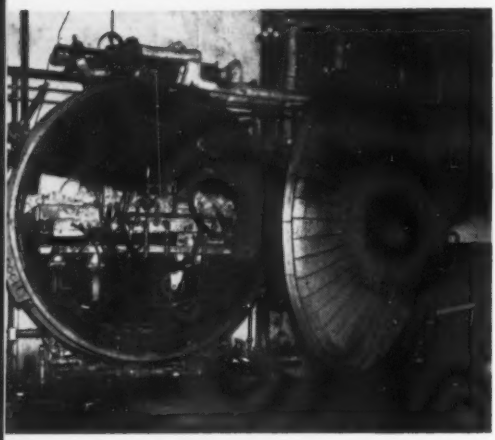
The platen itself was cast of aluminum, 4 inches thick, 6 feet wide, and 18 feet long. The steam heating coils of 1-inch I.D. condenser coil stock were "cast in" the platen body at the time of pouring. These coils, four in all, had to be rigidly braced in the mold to keep them from "floating" when the molten metal was poured around them.

Arrangement of these heating coils provides for even overall heating of the platen, both during its rise to temperature and during the



Huge 6 x 18-foot steam-heated hot platen, loaded with parts and covered with PVA sheet, is wheeled from lift into autoclave, which extends outside building to conserve floor space.

". . . curing cycle varies with type of material bonded . . ."



Here platen is in place in autoclave, and all plumbing connections (four steam inlets and four condensate outlets) have been made to the four heating coils contained in platen.

bonding cycle. These coils, two in each longitudinal half of the platen, are laced in closely coupled pairs back and forth across the platen width. During platen heating, opposite ends of the paired coils are used for admitting live steam, and for discharging condensate. Thus, where one coil is hottest (at the end where live steam is admitted) the other is coolest (where condensate is being discharged). This temperature difference between each set of paired coils varies in direct proportion throughout the length of the pair—as one coil gets cooler the other gets hotter. As the result of this arrangement, the same average amount of heat is dissipated into the aluminum platen structure throughout the length of each coil pair.

Both the steam attachment and condensate end of each of the four coils are brought out through the platen bottom so that external plumbing can be arranged as convenient. A single 3-inch live steam pipe feeds into this plumbing. The condensate discharge ends of the four coils feed into plumbing which terminates in three steam traps located outside the autoclave.

Each heating coil has its own automatic recorder-controller which controls the automatic steam valves admitting live steam to the system. At the start of the platen heating cycle, large 1-inch steam valves are used to speed up initial heating. But when the platen temperature approaches its critical range, ½-inch steam valves are automatically cut into the system. These ½-inch valves are more sensitive and aid in keeping the platen within the desired temperature range.

When the part components being bonded are of solid material, an unrestricted platen temperature rise is employed, although the platen temperature is maintained within plus-or-minus 5 degrees F. throughout its area during the rise period. When honeycomb parts are being bonded, platen temperature rise is restricted to 5 degrees per minute to allow gases to escape from the honeycomb structure. The curing cycle at bonding temperature varies with the type of material being bonded, and is specified for each classification of parts.

In tracing a complete bonding cycle, the flat parts with the bonding material applied are loaded onto the platen while it is out of the

autoclave. PVA sheeting is then stretched over the parts and sealed along the edges with zinc chromate paste. A vacuum is then drawn under the sheeting so that external atmospheric pressure will hold the work firmly until the platen is in the autoclave.

The platen itself is mounted on a 4-inch thick sheet metal housing for the external plumbing, and the housing in turn is mounted on a dolly. This permits wheeling the loaded platen onto a hydraulic floor level hoist very similar to the hoists used in automotive service stations. The hoist is then raised so that its tracks coincide with the dolly tracks inside the autoclave. The platen is then wheeled from the hoist into the autoclave.

At this point, both the steam and condensate connections are made. The autoclave is then closed and pressurized to 50 p.s.i. This requires about 2 minutes. The autoclave pressure quickly surpasses the atmospheric pressure caused by the vacuum under the PVA sheet, and the additional pressure further enhances the "glue line" between the parts being bonded.

The platen is then brought to temperature, either at an unrestricted rate or at a controlled rate if honeycomb materials are involved. At the end of the bonding portion of the cycle, a cold water spray is turned on inside the autoclave to speed platen cooling. After platen cooling, the spray water is blown from the autoclave with compressed air. The autoclave is then opened, disconnections are made, and the platen is wheeled out onto the elevated hoist to be unloaded and begin another operational cycle.

This huge platen with its associated operating equipment has materially increased the production rate of flat bonded assemblies in the Douglas Long Beach plant. But Douglas tooling engineers strongly advise against haphazard platen designs for this type of work. The temperatures employed in metal bonding are extremely critical, and maintaining an even temperature throughout a large platen surface is no mean task. But under test conditions and in production, the paired heating coils with steam flowing in the opposite direction through each of the coils has effectively solved this even platen heating problem in the Douglas Long Beach plant.

"You have a bonus coming Braunnowitz . . . How do you want it?"

FACTORS TO BE CONSIDERED IN

Selecting a Tape

Study conducted for equipping new plant with most economical and practical machine for manufacture of prototype inertial guidance equipment.

By E. PANFIL
Ordnance Department, General Electric Company, Pittsfield, Massachusetts.

While the application of tape controlled machine tools to repetitive manufacturing operations may be obvious, the same does not hold true for the job shop operation. In order to determine where a tape controlled machine tool can be utilized to the best advantage in a job shop operation, a study embracing a number of significant factors must be conducted.

Here at the General Electric Ordnance Department we were doing the planning to equip a new plant for the manufacture of prototype inertial guidance equipment. We knew that there was a place in the manufacturing cycle for a tape controlled machine tool, and we wanted to obtain one both to gain experience with this type of equipment and to train personnel. But funds were limited and we had to be certain that the machine we procured would be both practical and economical for our operation. Ultimately, we selected a Burgmaster automatic turret drill press with a General Electric Mark II numerical control. Why we selected this particular machine is detailed in the following discussion of the study we conducted.

Our study covered two major areas. The first was the determination of the type of machining operation from which we would derive the maximum benefits of numerical control. This included a consideration of machining operations and tooling. The second phase pertained to the actual selection of the equipment and involved the review of parts to be machined, tolerances to be met, standardization, and degree of automation. Each area was investigated in depth and the decision we reached was based on the correlation of data obtained.

Details of Factors Studied for Operation Selection

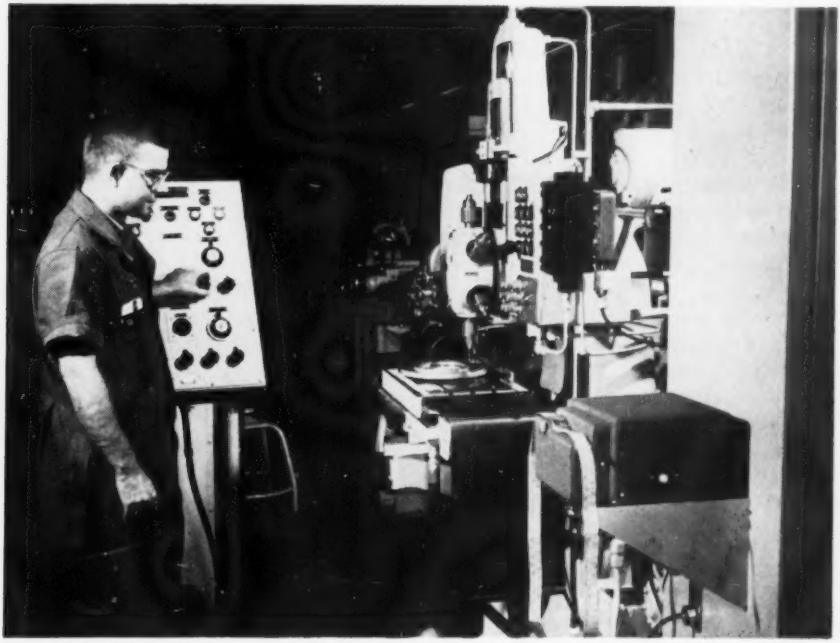
Since milling, drilling, boring and turning generally provided our major work load, consideration was given these operations in the light of numerical control application. Initial investigation resulted in the elimination of turning because of the lower job content in this application. Of the other operations

Controlled Machine Tool

FOR A JOB SHOP OPERATION

studied, it was found that most of our point to point positioning moves resulted from drilling. This was partly due to the comparatively large number of holes per component part.

The ratio of manual handling and positioning time to actual chip making time also proved higher for drilling. With the cutting cycle constant for like feeds, regardless of the manner by which the feed selection is made, reduction of manual time offered the greatest potential for savings. With respect to drilling, this was even more true for, more



Burgmaster automatic turret drill press with General Electric Mark II numerical control being used to drill workpiece with series of holes with locating tolerances of plus 0.001, minus 0.000 inch. Tape reader for controlling drill operation is shown in foreground.

often than not, the feed itself was a manual operation.

A review of our tool engineering records showed that of all the fixturing dollars expended for machining purposes in the past, 70 percent of the total was associated with drilling operations. Milling and boring were slightly less than 20 percent. The percentages listed refer to machining operations only and are not related to our total tooling content which also includes welding and assembly fixturing, among others.

The elimination of tooling was of prime importance since the guidance system was still in a fluid state and design changes, based on development evaluation, were occurring frequently. The task of keeping tool changes in phase with component revisions would present a complex control problem. Minimum tooling requirements would also provide the additional benefit of reducing the lead time normally required for the design and fabrication of the necessary tools.

A look at the equipment that could perform all of the desired operations, and also reduce our tooling requirements, revealed that cost was considerably more than we intended to expend although this was related to a corresponding increase in versatility and capability. This was also true of precision boring equipment. Retrofitting, although less expensive, did not appear to be an appropriate substitute for equipment specifically designed for numerical controls. In view of our fund limitations, the higher manual time content and the favorable tooling aspects, it was decided to concentrate on drilling equipment.

Details of Factors Studied for Machine Selection

The parts considered for machining were components of an inertial guidance system generally less than 100 square inches in area and 3 inches in height. These varied in configuration but usually were rectangular or round. Hole diameters ranged from No. 52 to ½ inch in diameter and up to 127 per piece in number. The majority of the components were stainless steel with the remainder divided among aluminum, brass and titanium. Lot quantities might be expected at anywhere from one to twenty. A 10 x 16-inch table and a ¾-inch drill capacity would be adequate for these parts.

The maximum design tolerances, regarding hole location on these parts, were plus or minus 0.005 inch. The greatest number of these were in the plus or minus 0.0025-inch range as a result of plus 0.005, minus 0.000 inch requirements. Equipment capable of working to plus or minus 0.002 inch tolerances would do our particular job.

Since this was our initial step in this field, and would be eventually followed by other tape controlled machine tools, standardization was desired. A survey of existing numerical controlled equipment indicated a trend toward the 1-inch wide 8-channel tape as a means of data input. Equipment for the preparation and interpretation of this tape,

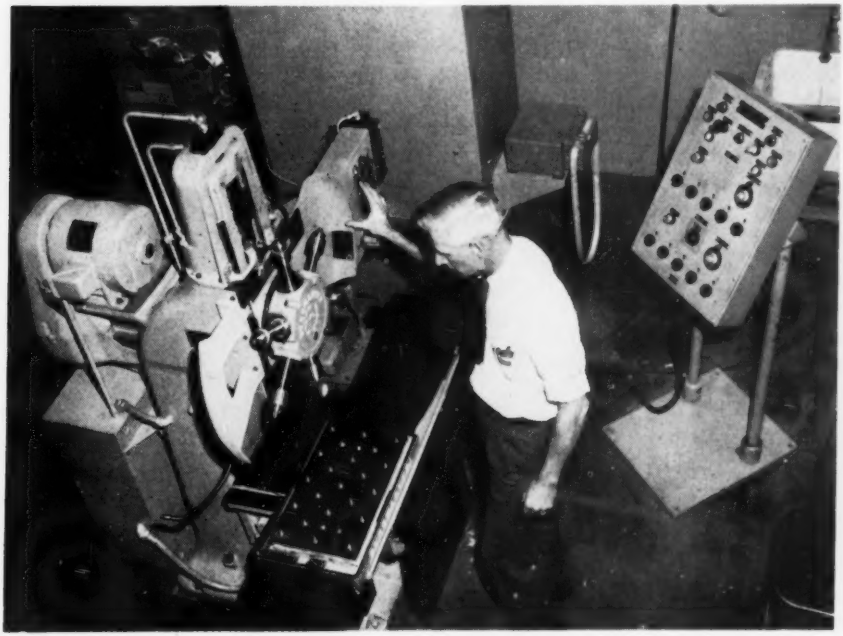
used quite extensively in business offices, was readily available.

Degree of Automation

To take full advantage of automatic positioning, it was desired that the machine tool incorporate an automatic cycling feature whereby once the spindle was initiated it would go through a complete in-out drilling cycle. A multiple spindle would offer the further advantage of minimizing tool changes.

Of the machine tools investigated and measured against the needs set forth by our study, the one showing the most promise was the Burgmaster turret drill press. The table size and travel of the 2BH Model fit in well with our requirements. Other favorable factors were (1) the preselection of spindle speeds and feeds, (2) the presetting of depth stops, and (3) the establishment of rapid approach and return points during the set up. These provided a completely automatic cycle through the selection of the desired spindle by tape.

Although this machine tool, with respect to drilling, conformed very nicely to our requirements, the control system then associated with it was not compatible with the means of input that we had established as standard. When we saw this equipment integrated with a G.E. Mark II control system at the '58 Tool



This view of the G.E. Mark II numerical control-equipped Burgmaster automatic turret drill press shows operator checking hole location with a dial indicator mounted in chuck.

Show in Philadelphia, we felt we had hit upon the combination we needed and we put in our order.

Equipment Development

Because this was our first numerically controlled machine tool, an equipment development program was planned. When received it was installed in our manufacturing laboratory where a series of calibration and operating tests were conducted. Installation of the control system was a comparatively simple task, accomplished by our maintenance personnel without the presence of a service representative from the manufacturer of the control system.

The capability and capacity of the machine was evaluated, experience was gained in the programming aspects, and personnel were trained in its operation. Consequently, when the machine was set up in our shop operation, it was all set to start turning out parts.

"Miss Jones, everything you do here is wrong. What are you doing tonight?"

Operating Performance

The performance of the tape controlled drilling machine since it was placed in shop operation in December 1958 has been extremely satisfactory. A study of the first three jobs processed indicated an average 63 percent reduction in machine cycle time. Although not checked recently, this figure should be considerably higher now because of the additional experience gained. The tape controlled drill actually reduced the jig borer load to the extent that it was possible to cancel the planned move of a jig borer to the guidance machine shop for small lot work.

A report, issued by our inspection group on the work processed during the first month of operation, showed that not a single workpiece was rejected for incorrect hole locations. In fact, two parts, approximately 6 inches in diameter and containing eight holes with locating tolerances of plus 0.001, minus 0.000 inch were produced within the designated tolerances.

However, tolerances such as these can be achieved only occasionally and under certain conditions. Results during normal operations show plus or minus 0.002 inch to be the more common figure, with the greater portion of these being near the plus or minus 0.001-inch range. This is because tool deflection, spindle variation and other such factors increase the potential error to some-

thing beyond the positioning accuracy of the table.

Future Plans

Our experience with this machine has made us keenly aware of the potential that lies in the field of numerical controls for our research and development type of operation. As a result, we have ordered a three axis tape controlled horizontal boring mill. If other plans are realized, three additional numerically controlled machine tools will be installed in our facility prior to the year's end.

★ modern machine shop ★

Metallizing Handbook. Published by Metallizing Engineering Co., 1101 Prospect Ave., Westbury, Long Island, N. Y. 345 pages. Ilustrated. Cloth binding. Price, $5.00 postpaid.

This completely new metallizing handbook contains a wealth of "how-to" information, including data on the very latest developments in the spraying, in powder form, of high melting point ceramics, such as alumina and zirconia, and hard-facing alloys including tungsten carbide. Profusely illustrated with pictures, diagrams, charts and tabulated engineering data, this text is said to be an invaluable reference for anyone concerned with product design and materials engineering, as well as with machine maintenance and the corrosion protection of iron and steel structures and exposed equipment.

New automated spraying equipment, electronically controlled, for high speed, production line spraying is treated in detail. An entire chapter is devoted to powder spraying, covering oxidation resistant alloys, ceramics, tungsten carbides and hard-facing alloys. The handbook also covers many miscellaneous metallizing applications, such as brazing and soldering on glass and ceramics; mass coatings in barrels; miscellaneous non-metallic materials, and model work. Engineering data is provided on physical properties of sprayed metals and ceramics, bond and tensile strengths, hardness, spraying speeds, and other important coating characteristics.

The book is illustrated with over 150 diagrams, photos, and charts, showing preparation methods, spraying operations, effects of gas and spraying feed adjustments, and distances; also listing information to aid in the selection of correct spraying materials, cutting tools, machine feeds and speeds, and so on. Complete information is also included to aid in estimating costs.

"It's a living wage, all right . . . but it won't take my wife long to kill it."

COLD EXTRUDING Steel Alloys

California shop extruds parts of practically any desired configuration to close dimensional tolerances and high surface finishes.

By GILBERT C. CLOSE
Field Editor, Modern Machine Shop

Although Ray Matthews, president of Matthews Manufacturing Company, Hawthorne, California, says that cold extrusion of steel alloys is still in the form of an art, and is not an exact science due to the many unknowns involved, it is hard to believe his words after a trip through the Matthews shop and a look at the work being turned out. Parts of nearly any desired configuration are being extruded from cold alloy steel slugs, and come out with dimensional tolerances and a surface finish which is claimed to be comparable to that obtainable on a high precision turret lathe.

Ray Matthews holds a large, closed-end 4130 steel alloy tubular component which was cold extruded from a solid metal slug. Note heavier section around open end of part.

Matthews, a mechanical engineer with an atomic turn of mind, used his knowledge of the atomic structure of metals in formulating process plans for this cold extrusion work. He reasoned that if enough external pressure was applied to the alloy steel, deformation along the slip planes within the metal grains was bound to occur. If sufficient external pressure was applied, deformation would continue to mount until the metal was actually in a plastic condition. When in this plastic condition, he continued to reason, it would flow in a die cavity and around the punch being used to apply the external pressure.

But a major problem stood in the way of such an accomplishment. The external pressure required to reduce a steel alloy to this plastic condition would exert about three times the normally acceptable stress and pressure on the tool steel used

to Precision

to make the dies. But here again Matthews was undaunted. He decided that if the right tool steel was selected, and if the die tools were carefully designed and properly heat treated, they would withstand the overload and produce upward to a half million parts without failure.

Subsequently Matthews proved his points, both as to the flow of the plasticized metal to conform to the die cavity and punch, and as to the life expectancy of properly designed and heat treated die tools.

Basically, in this cold extrusion work, a steel slug which contains the exact amount of metal required for the finished part is cut from billet or bar stock. Currently, most of the parts being produced are extruded from 4130 chrome-molybdenum alloy. The slug is then placed in the die cavity. As the die punch penetrates the die cavity at a relatively slow rate, it applies the external pressure on the slug necessary to reduce it to the plastic condition. Then, at a relatively slow rate, the metal flows upward around the punch and outward to fill the die cavity.

In die fabrication, Matthews uses Lehigh H (AISI D2) tool steel. This material was selected because of its compressive strength and its deep hardening properties. After the die components have been machined, they are heat treated at 1850 degrees F., air quenched and then immediately double drawn to

Here small cup-shaped components with an internal protrusion are being cold extruded on a company designed and built extrusion press. Note metal extruding upward around punch as punch descends into the die cavity.

the desired hardness. Then, after precision grinding to the desired tolerance, they are again drawn at 950 degrees F., and air quenched. Matthews estimates that dies produced and heat treated in this manner will extrude from 150,000 to 200,000 parts before replacement is necessary. At the same time, he estimates that a tool used to produce the same part by hot working would have a life expectancy of approximately 5,000 parts.

A second problem that had to be solved was proper lubrication of the slugs to be extruded. This was worked out chemically, so to speak, and is performed on the initial slug, and on the partially finished part itself when it is cold extruded in several stages. The material is first pickled in sulphuric acid, then rinsed in cold water. This is followed by a zinc phosphate treatment at approximately 135 degrees F. The

". . . there is very little restriction on form or configuration."

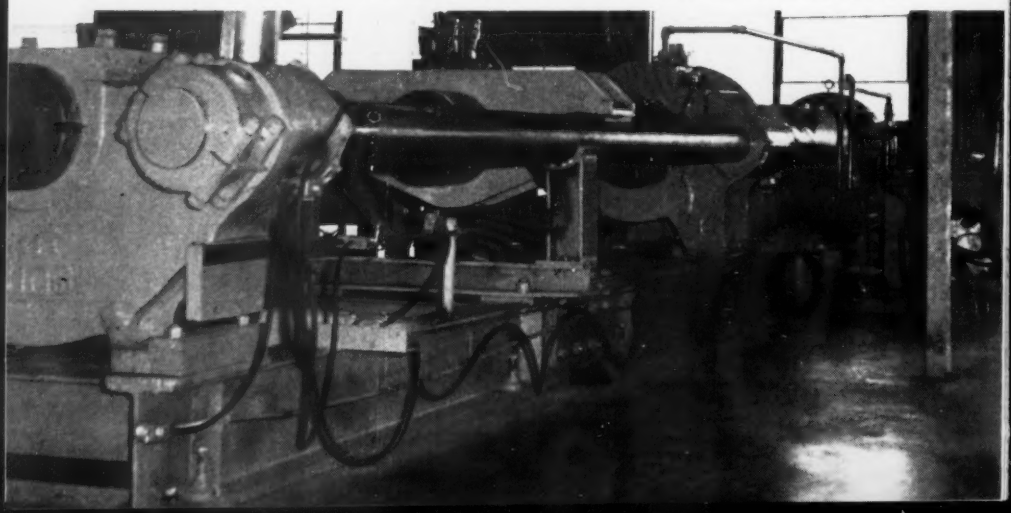
zinc phosphate is then neutralized at 130 degrees F. After this surface treatment, the part is coated with a commercially available soapy lubricant at 160 degrees Fahrenheit.

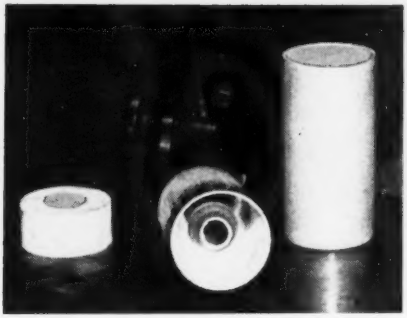
Matthews points out that the zinc phosphate is a reactive type lubricant that adheres to the steel throughout the extruding process, and is actually the key to successful lubrication in this type of work.

As to the parts or products produced by the cold extrusion process, there is very little restriction on form or configuration. In fact, one highly desirable feature of the process is its lessening of restriction on design configurations. Of course, as with all metal forming techniques, some shapes are easier to produce than others. In cold extrusion work, a closed-end, straight-sided can-shaped configuration would fall in this category. However, outsets on the can shape, as shown in one of the accompanying illustrations, are merely a matter of die configuration to produce the desired shape. Many parts are produced in a single extruding operation. More complex parts in which the metal must be moved great distances may require several stages of operation.

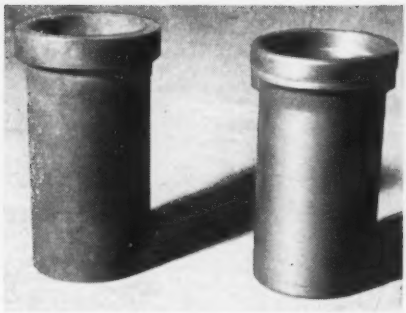
From the metallurgical standpoint, although the steel alloy slugs are fully annealed prior to extruding, the metal in the extruded part will exhibit a yield strength up to 300 percent greater than that of the original slug. Micro-photographs show that tremendous metal grain refinement occurs and elongation is not drastically effected despite the increased yield strength. As an added advantage, physical properties of the extruded metal are the same in both the transverse and longitudinal directions. To compare this, coupons were cut from identical parts—one machined, the other extruded. The coupons were removed from identical areas on both parts, but this area was selected so

General view from rear end of company designed and built 1000-ton extrusion press.





Close-up view of parts shown being extruded in previous illustration. Original slug is at left. Note upward protrusion which has been extruded into cup laying on its side.



(Left) A 4130 steel alloy part just as it came from the extrusion press. (Right) Identical part after minimum machine work to cut internal and external threads on the flange.

that tensile stresses would be applied to the coupon at right angles to the normally weakened plane caused by machining. Under tensile test, the extruded coupon withstood 10,000 pounds pull, while the machined coupon failed at 4,500 lbs.

As they were not commercially available, Matthews designed and built all his own extruding presses. His largest is a 1000-ton horizontal monster which can cold extrude alloy steel throughout a die cavity and around the ram seemingly as easy as grease flows from the nozzle of a grease gun. Two smaller extrusion presses were also designed and built.

When desired, and with the necessary die cavity and punch smoothness, parts can be extruded with a very fine surface finish, ranging downward to 8 micro-inches. Radii on either the punch or in the die cavity are not critical, and very sharp yet perfect corners, junctures, and so on, are being successfully extruded. On production work, tube wall thicknesses down to 0.005 inch have been successfully extruded. In experimental work, even thinner extrusions have been produced. Finished tolerances (tube wall thicknesses, flange dimensions, and so on) are normally held to 0.001 inch on production work.

From the commercial standpoint, Matthews has this to say. "I reasoned from the beginning that it would be cheaper to move metal by an extrusion process than to machine metal away to secure a desired shape. This proved true, and we are now competitive with any other method of metal forming or machining. In addition to this, the cold extrusion process has advantages inherent of many other forming processes, and some advantages not found in any of the other processes. Briefly enumerated, these advantages are . . . inexpensive tooling, very close tolerances, strength of the extruded metal comparable to that of forgings, good surface finish on the extruded part, economical high-volume production runs, and, perhaps the most important of all what approaches complete freedom in design configuration."

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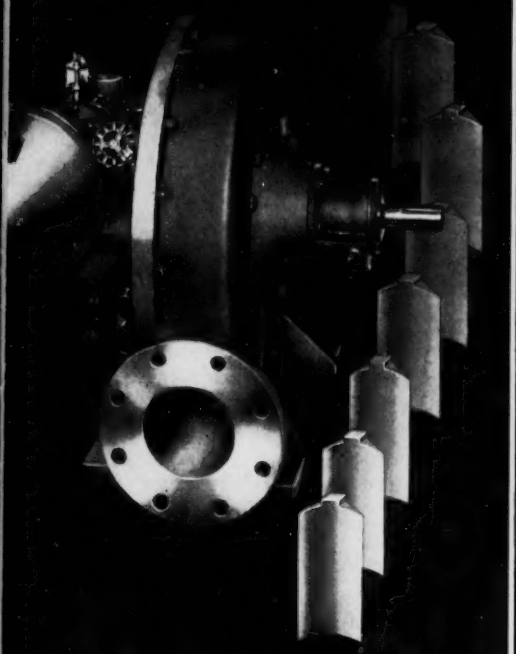

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A CASE HISTORY—

Machining Stainless Steel

Reduction in end mill overhang, together with modification of work-holding method, solves poor tool life problem in slotting valve bodies.

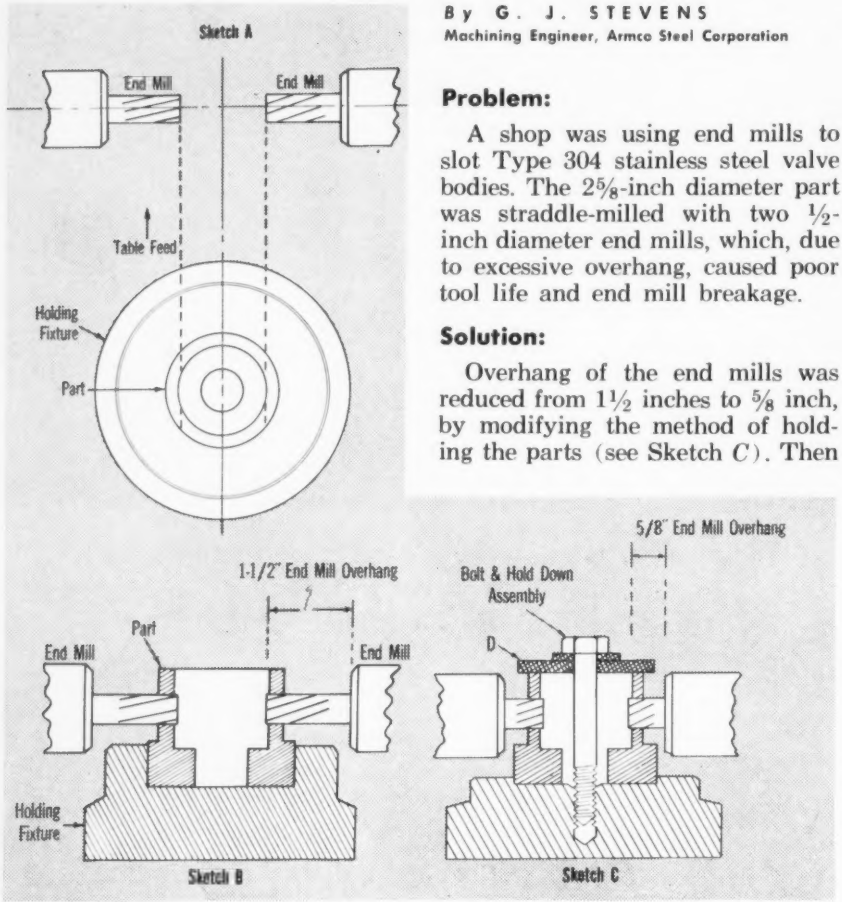
By G. J. STEVENS
Machining Engineer, Armco Steel Corporation

Problem:

A shop was using end mills to slot Type 304 stainless steel valve bodies. The 2⅝-inch diameter part was straddle-milled with two ½-inch diameter end mills, which, due to excessive overhang, caused poor tool life and end mill breakage.

Solution:

Overhang of the end mills was reduced from 1½ inches to ⅝ inch, by modifying the method of holding the parts (see Sketch *C*). Then



Sketches show how end mill overhang was shortened and the method of holding the work was modified to increase tool life in slotting valve bodies made of Type 304 stainless steel.

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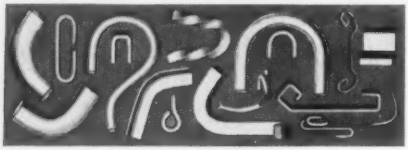

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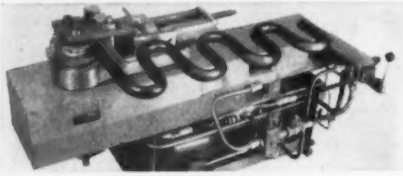

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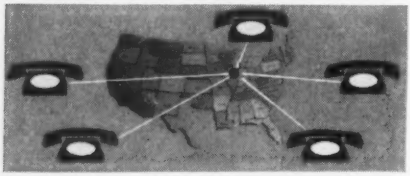

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Machining Stainless Steel . . .

the part was bolted down internally, which replaced the former method of holding the O. D. of the part (see Sketches *A* and *B*).

The hold-down washer, *D*, in sketch *C*, was slotted slightly larger than the diameter of the bolt to permit rapid loading. The part was milled satisfactorily with the short type end mills.

★ modern machine shop ★

The chip illustrated below, measuring 6⅜ inches in overall length, is one of several hundred made with a 3-inch high-speed steel twist drill driven at 0.100-inch feed in mild steel by a Cincinnati Bickford 19-inch column Chipmaster radial drill. The machine was powered by a 25 h.p. motor. A 20,000-lb. thrust load was developed. The chips were made to demonstrate the rigidity, power, and thrust capacity of the recently redesigned Chipmaster line of 13, 15, 17 and 19-inch radial drills.

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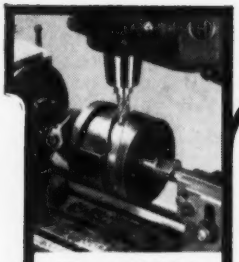
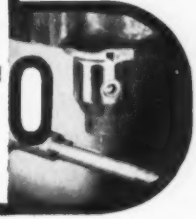


"Standard" B & S 4 flute, ½", taper shank end mill cutting cam track in annealed steel.

"Standard" B & S 4 flute, ⅝", extra long, fast helix end mill peripheral milling vertical slot—note: square end and bottoming cut.



"Standard" B & S 2 flute, 3/16", straight shank, double end end mill cutting key slot in arbor—note: double end doubles production before resharpening.

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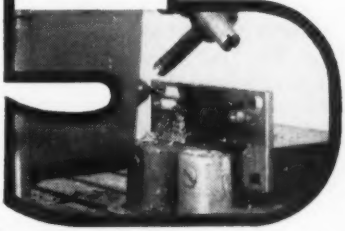

"Standard" B & S 4 flute, ½", fast helix, double end end mill plunge cutting and slotting boiler plate.

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Continuing his discussion of heat treating procedures, the author presents some time and money-saving suggestions for minimizing distortion in heat treatment.

By A. S. EVES

Naturally anyone who invests time and money in tools or machine parts wants to see them come through heat treatment with the least possible distortion, and hopes they will not crack. So, too—let us hasten to add—does the heat treater! Not only because excessive warping may cause breakage of tools or parts, but because one of his big problems is to maintain original shapes.

Manufacturers work to much closer tolerances today than they used to and consequently turn out machines which run truer and more quietly than those of the past. Remember how the old fashioned automobile sounded when it was idling? Like a skeleton doing a dance on a tin roof.

In many a factory, distortion caused by heat treating has been a hindrance; for although this may not be too serious in the case of some jobs, in others any great amount of "movement" is a matter of grave concern.

Not infrequently the professional heat treater is asked: "How much will this piece warp in hardening?" He usually can judge from the shape and the type of steel whether much movement is likely. But still his answer must be largely guesswork, since there is no absolute way for him to gage internal stresses which may *release* during treatment.

Less cautious customers simply send out jobs with instructions merely to "Harden this straight!" Such orders of course are vapid and vague. For not only do they fail to state the tolerance for straightness, or how much stock was left for grinding, but they show complete ignorance of the fact that many parts are bound to come out of the quench looking like a snake—and nobody on earth can stop it.

The spindle shown in Fig. 1 is a good example. In the first place, it is unusually long. Further, there are no less than four different diameters. That keyway, too, helps to create an imbalance.

Even if this spindle were more regular in section, long parts seldom stay straight when heat treated. The same is true of plates and discs, which tend to warp and "dish"—especially if they contain no perforations. If jobs like these didn't distort, it would be a sort of miracle. Moreover, warpage becomes even more probable as (1) lengths increase and (2) thicknesses diminish.

The plain truth is that whenever steel is heat treated, you can begin to look for some distortion. And not just one kind of distortion, but *two*: (1) dimensional change (growth or shrinkage) and (2) changes in shape (bending and twisting).

This blunt statement may come as a surprise, for usually distortion is laid in the lap of the heat treater. That, however, can be far from right and just. The real picture is more clearly seen when you consider the following five facts:

(1) *Steel expands when heated, and contracts when cooled.*

Every schoolboy knows that. All would be fine if the movement in each direction were the same—that is, if the steel always would go right back to its original size and shape. Actually it seldom does.

Here is a valuable hint—something that few persons know. You will do well to remember it:

When steel is heated, it does not dilate the same amount in cross section as it does with the grain!

This can lead to some peculiar results. The sketch Fig. 2 shows a 5-inch square bar of steel. Regardless of its length or make-up, it is a known fact that when heated to the hardening range it will grow lengthwise with the grain (the direction in which it was rolled at the mill), precisely $\frac{1}{8}$ inch per foot—no more and no less. But here's the catch: the movement in the opposite direction will *vary*. That movement depends on several things, including shape and the temperatures used.

Let us now cut the bar into cubes. First they will be faced off; the mill decarb removed. After that it's only too easy to lose all track of which way the grain runs. If the operator should happen to turn one block around before he shapes all four blocks, do you see what the result can be? Blocks *A*, *B*, and *C* will treat alike; but *D* may turn out

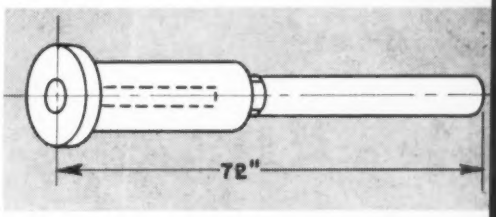

Fig. 1—Drawing of workpiece having several diameters and other areas that exemplify various portions vulnerable to distortion.

quite different. And somebody will add to his grey hairs trying to figure out why.

(2) *Heat treatment alters the shape and size of the tiny grains of which the steel is composed.*

Metallurgists know that steel can be hardened only by altering its crystals. A volume change may occur, regardless of care. Much as grains of popcorn become bigger when heated, the crystals in steel enlarge. Steelmakers freely admit there's just no such thing as a "no change" steel.

(3) *Light sections heat through and cool off faster than do heavy portions — and the former exert an incredibly powerful "pull".*

No heat treater can upset the laws of physics. Heat travels from the surface of a piece to its center. Where this distance is pretty much the same all over (as in a ball or cube), fine. But if sections are long and thin, warping can be expected —and where light and heavy sections occur in the same piece, few persons realize the tremendous pull exerted by a fast-cooling light section, and how willingly a thick section that is hot and pliable will respond to that pull. The tail actually wags the dog.

(4) *Steel is extraordinarily sensitive. Most anything you do to it will bring about some internal change.*

If you've seen a piece warp in grinding, you know this is so. All steels contain some internal stresses, put there first by processing before treatment with later additions due to heating and quenching. These stresses are invisible, but they're there just the same. They greatly affect the final shape of a die or other object. They explain why fracture is not uncommon when heat treating complicated shapes.

Here is a simple example. Take a piece of thin flat spring steel, as shown in Fig. 3, and bend it 90 degrees. This bending will set up internal strains. When the steel is heated and quenched, the piece takes a different shape.

(5) *Sulphur or lead added to steel improves the machinability, but they don't help turn out jobs that are uniform in hardness and low in internal strains.*

Do you realize that stresses from various causes actually can build up inside an innocent-looking piece of steel to the point where it may "explode" of its own accord? Fortunately there are, as you shall see,

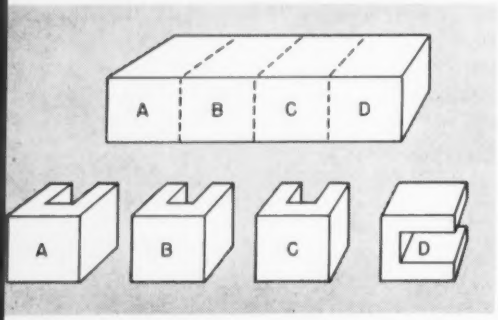

Fig. 2—Example designed to demonstrate the difficulty of determining in advance the direction that movement in a workpiece will be when it is heated to the hardening range.

ways to relieve most strains; but there seems no way to remove ALL of them. Those that remain are called "residual," which merely means "left over."

Well-chosen steels and balanced design help much to avoid change in heat treating. On the other hand, the treatment may bring to light some "built-in" errors. You should clearly understand that while a heat treater can indeed do much good or harm, the basic causes of distortion are: (1) natural causes, such as shape; (2) stresses built into steel before treatment; and (3) those stresses which are added during heat treating.

Not only do some shapes just naturally tend to warp, but there are manufacturing operations which take their toll yet cannot be avoided. For instance, the steel mills roll the ingots, squeezing them under tremendous pressure to produce bars. That gives rise to stresses. Then if the steel is cold drawn, still more stresses are added. Next comes the manufacturer who with rare exceptions must do some of the following: forging, hammering, peining; machining; bending, forming; thread rolling, knurling; upsetting, cold heading; welding, torch cutting; hobbing; swaging; deep drawing; letter stamping, prick-punching; extruding; and grinding. All build up strains within the steel!

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Now the manufacturer may be aware that the steel he buys contains some stresses, that he must add more, and that heat treatment will boost the total still higher. Maybe he is aware that stresses cause mis-shapen results; or he may be blind to all of these facts. Whether he is or not, almost invariably he will beg the heat treater to avoid distortion, for if shape can be held, it may be possible to omit a straightening or grinding operation after treatment. Happily, such pleasing outcomes are frequent, but only when *everybody* along the line does his part.

Very often distortion can be held down by a little planning or forethought. It is up to the manufacturer, for instance, to choose steel carefully, control the design, keep cold working to a minimum, to think about tolerances, and finally perhaps arrange for some beneficial "conditioning" (explained later) to be done before the hardening operations begin.

Though, of course, price is important, it isn't everything. The most expensive variety of steel may be far from best when it comes to standing up on a tough job. Yet a low priced steel, which usually offers

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ease of machining, may in the long run prove poor economy if it demands a quench that is too drastic.

Your steel supplier knows this and will gladly help you to choose a steel of suitable make-up, grain size, and hardenability. He will explain that the more highly alloyed steels must cool more slowly to obtain top hardness.

For an unbalanced, delicate die, a water hardening steel might be entirely wrong to use. Such steels must be cooled very rapidly, so they are (broadly speaking) the most apt to warp. Water quenching is commonly believed to cause more distortion because it is more severe than oil or air. That however is not precisely true. The distortion occurs because the quench (actual metal surface contact) is *uneven*. That causes extra internal stresses, and it is these that bring about the warping and cracking. But oil quenching is indeed less severe, so oil hardening steels give less trouble, while air hardening steels "move" least of all. Then too, a very common mistake lies in buying steel with insufficient carbon to achieve the desired hardness, at least without *forcing*.

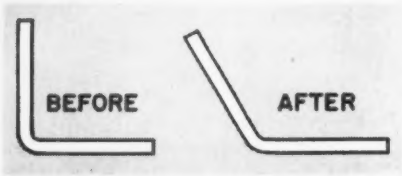


Fig. 3—Bending imparts internal strains to a workpiece which, after heating and quenching, is likely to cause the workpiece to assume a different shape, as shown in sketch.

Also, coarse grained steels, particularly those that are highly alloyed, tend to be bad actors in the matter of volume change. Moreover, as mass increases the hardenability of the steel becomes more and more important.

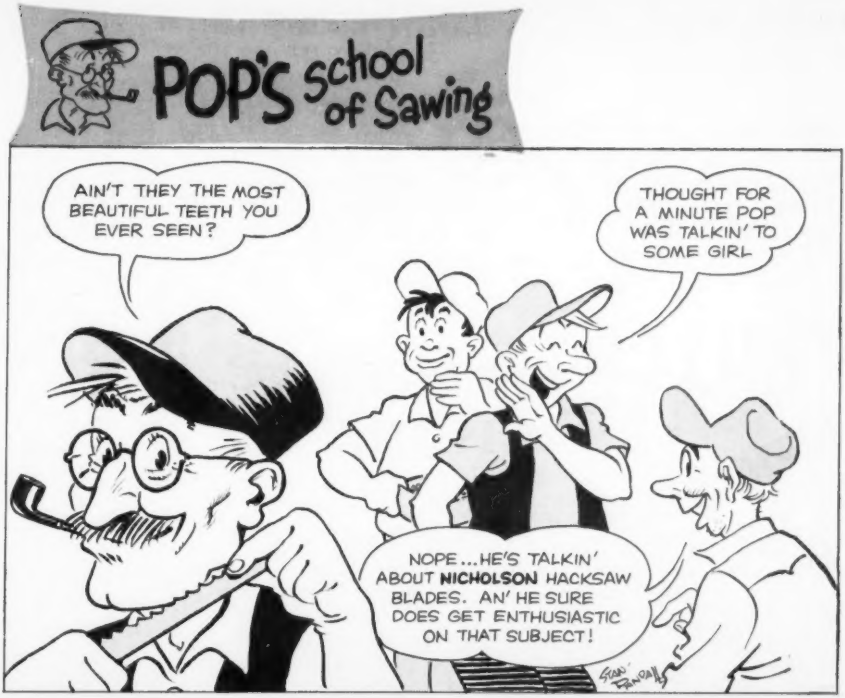
Occasionally, however, one should consider buying mild, low-carbon carburizing steels which can be case-hardened. For even if they do distort, their soft core makes them easy to straighten without danger of breakage. But the deeper the case required and the higher the temperature used, the more likely that some deformation will occur.

Engineers should think seriously about the relation between heat treatment and design. For instance, trouble can be expected when a piece combines light and heavy sections, particularly if there is a sharp corner. For in cooling, stresses tend to build up and distort the piece, perhaps to the point where it will crack. That sort of thing, even though it does occur during heat treatment, must properly be laid at the door of the *designer*.

If such items cannot be made in two or more sections, then at least there should be fillets in the sharp corners to increase strength and reduce the chance of disaster. Plates and discs can be helped by perforating them, since that simplifies the quenching.

Anyway, where dimensional limits are close there should be some heat treating tolerance allowed. If prints show a high and low, why leave the hardener no tolerance at all?

Just a word or two now about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machining. Since almost any machining, or grinding, will bring about some internal stresses, it is obvious that "hogging" (excessive cuts and feeds) makes matters worse. Common sense and care will pay off in the end.

Unless steel is to be case hardened, a good cut—sufficient to completely remove the mill "decarb"—should be machined off. This should be done equally all over. For if you take, say, 1/16 inch from the top surface of a piece of bar stock but remove little or nothing from the bottom, when you heat treat that piece it is almost bound to warp badly. Why? Because the quenching medium will attack (cool) the machined side faster, so that side shrinks faster and pulls the piece out of shape, as shown in Fig. 4.

In somewhat similar fashion, the speed of heat removal in quenching is affected by the amount of roughness. Opposite sides of a piece should be of equal smoothness; any difference in this respect—even heavy tool marks—will set up an unbalanced condition which can cause a change of shape.

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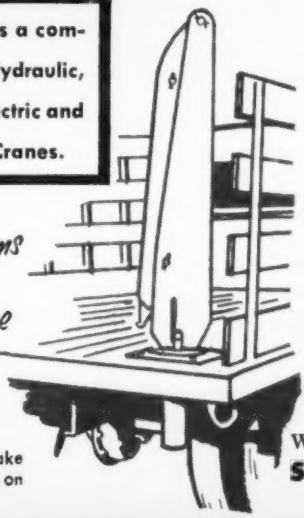

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wind up by cracking the steel when it's hardened. Whenever possible, use etching instead. To paraphrase a well known safety slogan: "The tools and parts you save may be your own."

In many cases, and particularly after forging or upsetting, and so on, it is well to rough machine the piece, then have it normalized and annealed. That will remove most of the residual strains, so when you do finish the part to reasonable tolerances for heat treating, it will not go into the furnace with two strikes against it. Such "pretreating" is not 100 percent insurance against distortion, but it helps mightily. Incidentally, the writer is convinced that no forging can be properly normalized until after the forging scale has been removed. And tools that, for one reason or another, must be rehardened should most certainly be fully annealed before such rehardening is tried.

How many engineers, machinists, and manufacturers follow such procedures as have just been outlined? Not nearly as many as should, before asking a heat treater to use his equipment and know-how. How many merely hand out jobs willy nilly with instructions to "Rush", and "Harden it straight!" — completely disregarding the natural causes of deformation or how much they themselves could do toward making things come out the way they want them?

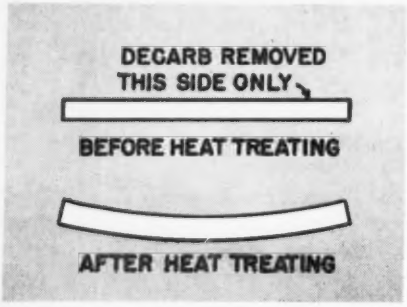


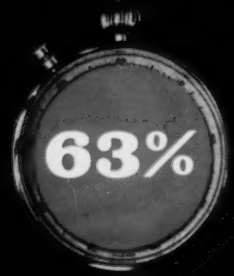
Fig. 4—Removal of stock from one side of a workpiece only will cause that workpiece to warp very badly during heat treatment.

Many take it on themselves to specify treatment without knowing what's new or what is actually best. In these days when new techniques are appearing in a dizzying procession, one must certainly be well informed if he is to choose wisely and well. Most purchasers of heat treating would be far better off it they would take time to consult with the hardener, who, of course, *must* keep up the times.

A very good reason for doing so is one few people stop to think about. For strange as it may seem, you cannot expect the heat treater to automatically give you the best available treatment. He may know of a better way; but not only is he bound by your specifications, but unless otherwise instructed he always will follow the quickest and most economical course. Why? Simply because a better treatment might take two or three times as long, and cost much more than you are used to paying. Consequently, he won't use it unless you specifically authorize him to do so.

If after you have done all you can, hazards still remain, a lot of them *can* be, and will be, taken care

For more data on advertisement on opposite page, circle 414 on Postpaid Card



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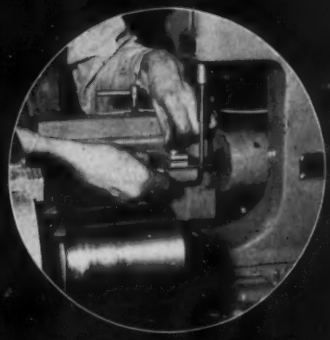
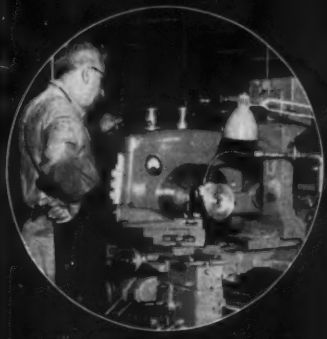


Inserting flat template in Copymatic prior to machining blank already chucked in lathe.



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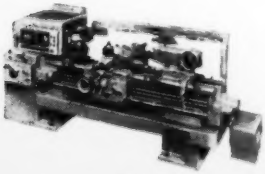

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of by the professional heat treater. Do not hesitate to talk freely with him. He isn't going to look down on you if you don't happen to know metallurgy. The chances are he doesn't know your particular trade either.

He can't do the impossible. Despite close harmony, there will be some distortional woes. But they will be fewer if cooperation is not lacking. It takes *two* to cooperate.

The Heat Treater's Part

Once a job is turned over to the hardener, his duty is twofold: (1) to follow good commercial practice and (2) to avoid any "sins of commission or omission" which might cause more change in size or shape than may normally be expected to occur. He usually can be depended upon to handle work with care, intelligence, and proper equipment.

Modern heat treat plants have special devices of one kind or another to help hold distortion down, but proper handling is vital.

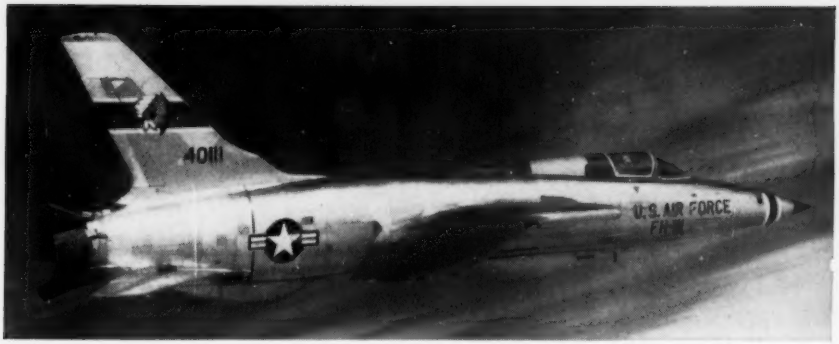
Since slow application of heat is best, the hardener should avoid rushing any job no matter who may be breathing down his neck to get it done faster. To shove steel into a hot furnace would result in "thermal" (heat) shock; so a warm-up at the start will be in order. This is called "preheating," not to be confused with certain pre-treatments such as normalizing and annealing. A professional hardener often will begin by putting a job on top of the furnace for a while—or, if he puts it into a furnace the temperature will be low. He then can either raise the temperature of that furnace gradually, or he can transfer the work to another furnace which is at a higher heat. This procedure not only holds down distortion, it also prevents burning corners and sharp edges.

Some folks think of heat treating as being done in a single furnace. Actually our work is far too complicated for that. There are heat treating jobs that call for as many as half a dozen furnaces to be used one after another.

One heat treater will use five controlled-atmosphere furnaces to harden a single high speed tool, two units at different preheating temperatures and a third unit at full heat; the fourth and fifth units are "draws." This sometimes is followed by freezing at *minus* 120 deg. F. Then comes a final tempering in still another furnace, perhaps with activated salts to improve the cutting quality. Another firm may use five to seven salt baths for similar tool treatment.

Makers of salt bath furnaces, by the way, say a coating of salt "cushions" the steel from heat shock as it is moved from one temperature to another. Also that a piece can't be overheated, since it never can get any hotter than the bath itself. Opponents argue that the heat in molten salts may be too intense. actually many different kinds of heat treating apparatus are being used with success.

Besides avoiding thermal shock, the heat treater can prevent warpage in other ways. He must always remember that when steel is hot it



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is soft and weak. Consequently, it may sag if the furnace hearth on which it is laid isn't perfectly flat. Or if a piece is laid on supports, the distance between those supports should be no greater than, say, three times the diameter or thickness of the piece.

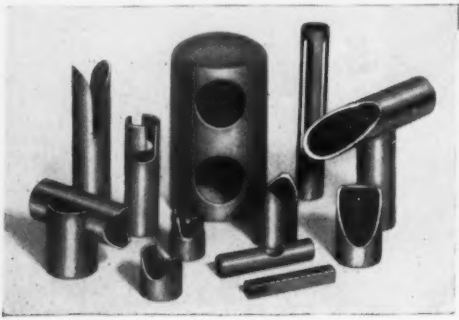
Then too, much warping stems from uneven heating and cooling. You already have been warned about light and heavy sections—but how about the furnace in which the heating is done? If the furnace happens to be very large, it will usually have in it some "hot" or "cold" spots that make for non-uniform heating and deformation of workpieces.

The heat treater must be very careful not to pile up work in such a way that the bottom pieces warp from the weight of those above. Indeed, if the parts are light enough, both the manufacturer and heat treater should see to it that containers are not overloaded, long before hardening begins.

A good hardener, of course, knows that some steels will warp if they are "soaked" (held at the hardening temperature) for too long a time. At least there is bound to be excessive grain growth. Again, other steels *need* a real good soak.

Even stopping-off (masking) when case hardening, to prevent carburization of certain areas, can create troublesome stresses.

There is yet another common cause of warpage for which the heat treater often is blamed but which actually goes back to the machine shop or the steel mill. For when



Look — at these sheared tubular ends — clean, true contoured and close fitting with a minimum of burr and distortion . . . *You can make them fast,* some up to

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ARC-SNUG prepares pipe ends for snug brazing—up to 500 pieces per hour.

ARC-TWIN® double notches pipe up to 750 pieces per hour.

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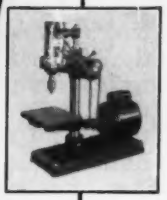
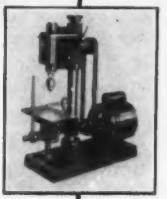
ALSO . . .

Three companion drills, each built to the same accuracy but differing in drive, speed range, and clearances, to cover the full range of special precision requirements.

AND A TAPPER . . .

with capacity from .034" x 120 to 1/4" x 24 . . . and a "reserve of accuracy."





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"Certain shapes must be jigged during heating and quenching."

steel is heated above its "critical" (the hardening temperature), whatever stresses happen to be in it will tend to *release*. The result often is a definite change of shape.

Heat-shock is greatest during the quenching (cooling) operation. The stresses then built up are more important anyway perhaps because they are being *added* to others already present. All the more reason to be careful. Slow cooling, like slow heating, can help; but, of course, if we make it too slow we may not achieve the hardness and structure that is needed. The heat treater can only watch out for jobs calling for a quench that really is too drastic.

The manner of quenching also can affect results. Long, thin pieces should enter the quench vertically. That alone can do much to reduce warpage. Broaches should not only be quenched up and down, they ought to *hang* that way in the furnace from the start. Gears sometimes are held on a rod laid across the quench tank, and spun. Circular saws, knife blades, and other flimsy objects perhaps can be quenched in a press, or between specially designed dies.

Certain shapes must be jigged both during the heating and the quenching operations. Also, wise use of spacers may help avoid deformation of work.

Some furnaces have a built-in quench tank. Work is loaded into mesh containers and these pass through the heating chamber into the quench, *automatically*. That means the parts are not dumped while hot. My, what a lot of warping (and nicking, too) suffered in earlier days has now been completely eliminated!

A worthwhile technique for quenching unbalanced pieces from the older type furnaces is known as "martempering." The items are quenched into hot oil or molten salts at about 400-600 deg. F., and held there until all portions are the same temperature; then they are removed and allowed to cool in air. Done this way, alloy steels change shape less and show greater strength than when cooled down to the oil quenching temperature of about 150 deg. F. The method does not, however, produce high enough hardness when the steel is a water hardening type. For these, there is a variation known as "time quenching." Delicate pieces are held in the water tank for just a few seconds and then promptly transferred to oil which is less severe.

Localized (Selective) Treating

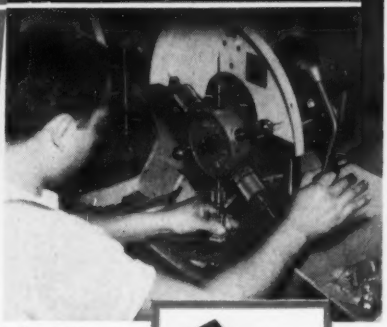
If hardness is not needed on all surfaces of a piece, but only in one or more relatively small areas, then to heat only those areas may well answer the problem of distortion. For the smaller the portion that must be hardened, the less likely the piece is to change size or to twist.

Professional heat treaters have on hand such things as lead baths, salt baths, induction machines, flame hardening outfits, and other means of restricting heat to just those portions of a piece that his customer selects. For instance, a very old procedure consists of immersing one

133% Production Increase Enables

BURGMASTER

Turret Drills to monopolize small hole drilling at Beckman Instruments

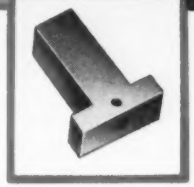


As a result of superior performance of the Burgmaster Machines since their installation, Beckman Instruments, Inc. is routing all new development jobs requiring machining of small holes to these 6 Spindle Turret Drilling Machines. Production is increased up to 133%, floor space required is reduced 66%, and these machines eliminate the waste motion and operator walking required to shuffle fixtures along a line of single spindle drills.

In the operation shown, an exhaust housing for a precision electronic device is now drilled and tapped in 1½ minutes. Formerly, on a line of single spindle drill presses, the same part required 3½ minutes, a production increase of 133% with the Burgmaster.

The greater rate of production is possible because the Burgmaster machine provides a 6 spindle turret that is power indexed to rapidly bring six separate spindles to the work at one point, eliminating fixture shifting and needless operator walking. **Pre-selective, automatically shifted** spindle speeds and precision depth stops for each spindle with **sensitive hand feeding** insure fine finish and accuracy with long tool life.

"The two Burgmaster Turret Drills relieved for other work two banks of six single spindle drills at a considerable savings in investment, space and cost of production. We use the Burgmasters around the clock because they save us time and are vital to our production."



JOB FACTS

Company: Beckman Instruments, Inc. Fullerton, California

Part: Aluminum Exhaust Housing for Electronic Device

Size: "T" shaped, 1¼" cross section by 3" long

Lot: 100

Holding: Fixture

Operations:
1. drill .070 to .190 depth at 4100 rpm
2. drill .128 thru at 1700 rpm
3. tap #2-56 (.070 hole) at 750 rpm

Advantages: 133% production increase, reduces floor space 66%, requires only a fraction of the investment, reduces operator fatigue. "Substantial savings in time apparent even on small lots."

Machine Cost: $595 plus extras

MODEL "O"
1/4" CAP.
IN STEEL

Your nearest dealer

will be glad to give a free demonstration of the Burgmaster to prove how you can cut your drilling costs. Ask for free literature.

BURGMASTER CORPORATION

SMALL TOOL DIVISION — BURG TOOL MANUFACTURING CO., INC.
15001 South Figueroa Street, Box 311, Gardena, California
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For more data circle 418 on Postpaid Card

end of a shaft for say 3 or 4 inches in a pot containing molten lead and holding it there until it becomes heated through. If hardness is wanted, the piece then is quenched. Only the dipped portion hardens, provided, of course, that the steel is of a hardenable variety or has previously been carburized.

In similar fashion, one end of a low carbon steel shaft could be case hardened in molten cyanide. In either instance, however, if too great a length is immersed, distortion still may occur. That depends somewhat on the thickness of the object being treated.

Now assume the area to be treated is near the *middle* of the shaft. Dipping just won't do. Some way must be found to heat only the desired portion. Perhaps an induction machine which will heat the specified area, within the electrical "field" of a copper coil. Or the job might be done with a flame hardening machine that employs oxyacetelene torches. Any such heating, if hardness is wanted, must, of course, be followed by quenching.

After the Quench

Tempering (or drawing) after the quench will help to relieve the hardening stresses and toughen the steel. This operation causes little if any distortion, except perhaps to decrease the volume of a piece—more noticeable as tempering heats are boosted.

Because the steel will have more "spring" to it after tempering, any straightening is best done during or before the draw, while it is more willing to take a "set." If flat items such as washers, discs, or knife blades which warp in quenching are clamped tightly in multiples in a jig, they usually come out of the draw pleasingly flat. Other pieces are best straightened by peining—or by using the force of the jet in a sandblast booth—to take out kinks.

There also are some straightening tricks that can be done with a hand torch. But here we find ourselves in a field that calls for a trained specialist with skill of a very high order.

Finally there are presses made especially for straightening. Big presses and little ones. We say "finally" for a very excellent reason. These presses do not take the place of forethought, judgment, and planning. You should always think of a straightening press as a *last resort*. For that's exactly what it is.

Stop and think a moment. A die that goes out of shape and has to be pressed back is not as good a die as one that requires no such pressing, because pressing imposes strains that would far better be avoided. These strains are *added* to any other already within the steel. Breakage often happens during the straightening operation, especially of those types of steels that harden clear through.

In fact, the Metal Treating Institute, national trade association of commercial heat treaters, says bluntly that no claim should be allowed for breakage in straightening since no one can tell when a piece will "let go." Every good, conscientious operator goes through

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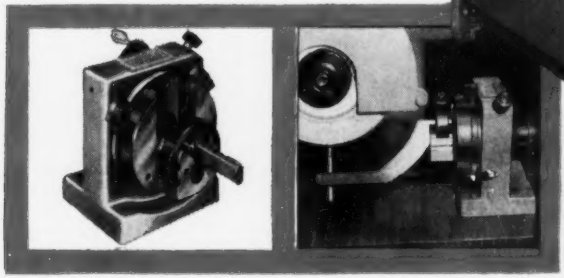
Now! Equip your tool-room with the most accurate, dependable surface grinder available. Out-performs many similar makes costing far more. Made by grinding specialists to assure you of superior results—time after time!

- Solid one piece construction of spindle housing and verticle slide.
- Elevating screw centrally mounted.
- Combination "V" and flat ways assure positive alignment.
- Angular rack and pinion face.
- Motorized spindle, dust collector and water unit available.



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For fast, accurate perforator grinding . . . milling, boring and inspection.

NEW! RADIUS DRESSER ARM
Quickly converts Harig's Grind-All Fixture into a precision Radius Dresser.

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Harig *Manufacturing Corp.*

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a little private hell which sears his soul when he's trying to straighten steel.

Few persons realize that just because a shaft, let us say, has been pressed into straightness there is no assurance that it will *stay* that way. Since such pressure creates strains within the steel, the piece may later change back again.

So the less straightening you leave for the presses, the better off you'll be financially, mechanically, and in point of time saved. But if there must be any such straightening, then by all means:

(1) Make sure that shafts have true centers, else it may not be possible to do a good job.

(2) Don't ask for closer tolerance than you need. If there's 0.030 inch of stock left on a side, it not only is costly but dangerous to insist on a 0.005-inch tolerance.

Commercial heat treat plants, by the way, usually consider 0.005 inch total indicator reading (TIR) is carrying a good thing far enough. But, of course, jobs do differ.

Freezing

Curiously enough, if steel warps slightly in heat treating it sometimes will return to its original shape when frozen for about six hours at minus 120 deg. F. On the other hand, pieces have been known to warp in the freeze; but such movement seems proof positive that there were stresses present, for the chilling has a stabilizing effect. The process has been used for many years by the manufacturers of gages.

After freezing, the steel should always be tempered.

Intentional Distortion

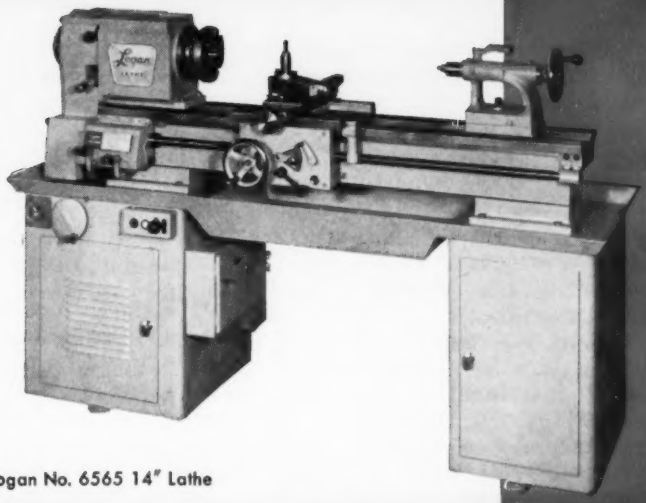
There are two kinds of intentional distortion. The first is where the job is highly repetitive and the amount of distortion to be expected from heat treatment is so well known that some allowance for this movement is made beforehand. That is, the part is made with a little extra bend, so it will come out just about right.

Then again, once in a while you may hand to your heat treater some pieces that are contoured and you want them back *still* bent. In such cases, never fail to notify the hardener of this fact, otherwise he may put in many hours doing straightening that isn't wanted at all!

"Allright . . . there's your old rush job . . . hot off the lathe."

its specifications add up to high production capacity

Logan 14" Lathe



Logan No. 6565 14" Lathe

Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-capacity features. For instance—

- An oversize spindle with 1⅝" bore turns on four super-precision ball bearings with built-in preload
- A variable-speed drive lets you change speed while work is turning—without shifting belts
- A warp-free lathe bed with high, strong walls braced by oversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground.

There are many more reasons why this and other Logan Lathes have a greater capacity. The complete specifications tell the story. Write for them.

- Spindle speeds to 2000 rpm
- 1½" Levermatic collet chuck capacity
- 14⅝" swing over bed
- 9" swing over saddle cross slide
- 40" between centers

LOGAN ENGINEERING CO. Dept. L-1059 4901 Lawrence Avenue, Chicago 30, Illinois

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more production through modernization

Techniques for increasing output with newly developed machines and tools.

Fast Stock Removal by Grinding

Among the workpieces being processed at Alignment Engineering Company of Warren, Michigan are many flat parts which require as much as ¼ inch of stock to be machined from each side. Several methods were tried including the application of cutter-type machines which normally are thought of as being best suited for this type of work. Of particular interest was a recommendation followed by the actual installation of a Mattison No. 24 vertical-spindle surface grinder equipped with a Quick-Tilt spindle.

This vertical-spindle surface grinder is equipped with a Quick-Tilt spindle that enables the user to switch from rough grinding to finish grinding in a matter of seconds.

In use now, as shown in the accompanying illustration, the Mattison No. 24 performs excellently as a stock removal machine as well as a high precision grinder. Actual performance on production runs indicate that machining time on the grinding of mild steel parts has been cut to 1½ hours from a total of 6 hours that had been required by a previous method. The rapid removal of metal is accomplished when, by merely a flick of a switch, a chuck load can be rough ground first, using an arbitrary 0.010-inch wheel tilt. In seconds, the spindle can be returned to the vertical position and a light finishing cut taken to produce perfectly flat parts.

A selector switch on the column of the No. 24 vertical-spindle rotary actuates an air cylinder that automatically tilts the wheel head and spindle toward the work, or back to dead flat. Then, after reducing the rate of down feed slightly to

keep power draw at the optimum, the machine is ready for the finishing cut and sparkout.

Efficient parts grinding is made possible through the elimination of an excessive amount of down time previously required for changing a single machine from a rougher to a finisher, and the elimination of the need for keeping two grinders set up for roughing and finishing.

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One-Pass Reaming and Chamfering Cuts Case Machining Time

With a single tool, three-in-one operation, machining time has been cut 65 percent with a substantial increase in production at Ford's Sterling Township plant. A special Cogsdill deburring tool makes two hidden inside chamfers and performs ream operations on all Ford, Mercury, Edsel, Thunderbird and Ford Truck differential case assemblies. Running four machines, two shafts, Ford machines 8,000 differential cases a day. The tool was designed by Cogsdill Tool Products, Inc., of Oak Park, Mich.

In a single pass, the tool reams the hole in the 0.750-inch entrance hole with an accuracy of plus 0.001 inch, minus 0.000 inch. Simultaneously, the tool makes two 0.045-inch inside chamfers at opposite ends of the differential case. The operation must be done in this manner because: (1) the case and cover are joined in a previous operation, necessitating chamfering internally from the outside of the case; and, (2) because a slave pin hole is drilled through the entrance hole requiring the burr removal.

Previously, three separate operations were necessary. The back-chamfering tool performed two operations with the case and cover separated. The reaming was done on another machine.

As the special deburring and reaming tool enters the case, four carbide-tipped reamer blades ream the hole. When the shoulder of the tool is compressed against the edge of the case, a cam pin swings out a double-ended, carbide-tipped blade to chamfer both inside holes.

The Cogsdill tool is used on a special Acar deburring machine, driven by a ½ h.p. motor operating at 850 r.p.m. The fixture guides the differential case into the tool. The operator loads and in one easy motion the operation is completed. Tools are changed only after 5,000 to 6,000 cases have been run.

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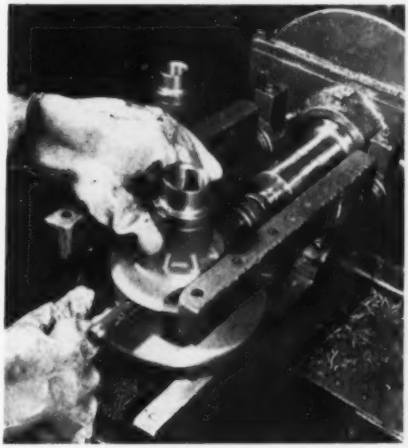

Operator at Ford's Sterling Township plant loads a Ford differential case into fixture guides for one-pass reaming and chamfering with a special Cogsdill tool.

more production . . .

Bench Model Turret Drills Double Production on Variety of Jobs

A shop that specializes in precision uses three Burgmaster bench model turret drills to drill and ream 43 holes (86 operations) in a gear box end plate in eight minutes to plus 0.0002-inch, minus 0.0000-inch centers and plus or minus 0.0001-inch diameters. This end plate is responsible for the alignment of gears with maximum permissible backlash of 0.0001 inch. High production of 43 holes of seven different sizes from 0.0785 to 0.8125 inch in 0.081-inch thick brass is made possible by power indexing of the six-spindle turret which rotates a sequence of tools around a common point at operator demand, rapidly performing a series of operations with a minimum amount of operator exertion as well as shifting of fixtures.

A leading producer of electronic equipment uses a Burgmaster six-spindle turret drill to machine six holes of five different diameters in a brass galvanometer body. This installation has increased production 63 percent, reduced investment 63 percent, and saved 60 percent floor space. The holes in the part range from 0.029 to 0.113 inch and are held to plus or minus 0.0005 inch in a jig.

A manufacturer of precision aircraft missiles uses a six-spindle bench model Burgmaster to center drill, drill and countersink a special Ni-Silver and gold plated aluminum stud with 120-degree hole separations at 60 per hour, more than doubling production compared to previous methods. The parts are held in a hand indexed, standard Hardinge collet index fixture. All three operations are performed at one setting, before indexing, holding tolerances to plus 0.003 inch, minus 0.001 inch. Preselective, automatically shifted spindle speeds for each spindle and sensitive hand feeding result in fine finish, accuracy and long tool life. Floor space has been reduced 66 percent, and it is estimated that during the machining of a lot of 550 parts, 2½ miles of fixture shifting have been completely eliminated.

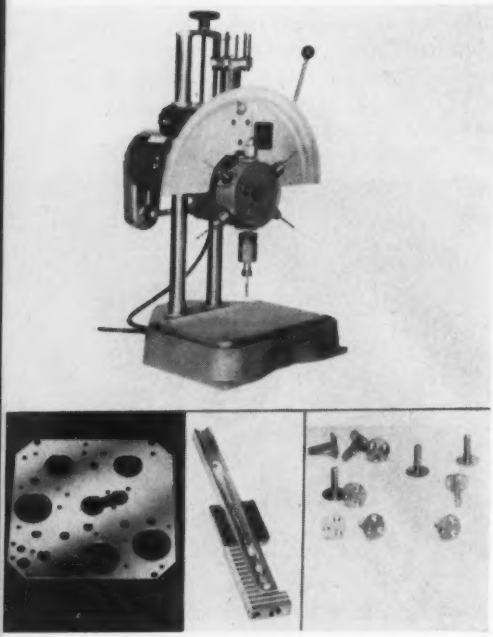

Illustration showing three typical jobs on which production has been more than doubled using Burgmaster bench model turret drill.

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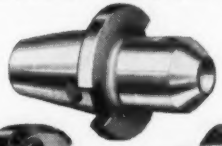
YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON / HOLDERS

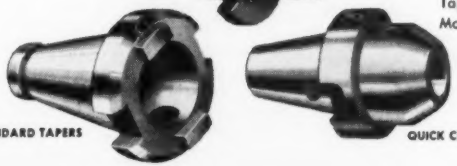
FOR END MILLS

Regardless of the type or size of Straight Shank End Mills used the best results are obtained by the use of Weldon End Mill Holders and Adapters. They are manufactured of finest quality material to a high degree of accuracy to assure concentricity of the cutting tool together with maximum holding qualities.

Holders carried as stock items to serve end mill shank diameters 3/16" to 2" inclusive.

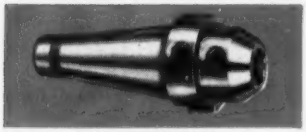


Weldon holders are used on all makes and types of milling machines and boring mills having National Standard Non-Sticking Tapers or the Brown & Sharpe or Morse type of tapers.



NATIONAL STANDARD TAPERS

QUICK CHANGE ADAPTER AND HOLDERS



2-SCREW DRIVE HOLDER
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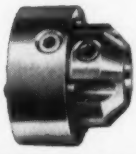
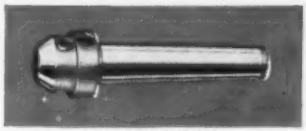


HOLDER WHICH DIRECTLY BOLTS ON STANDARD MILLING MACHINE SPINDLE. DRIVEN BY KEYS ON SPINDLE NOSE

SINGLE SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS

SINGLE SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS



2-SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS

Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

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Production Broaching of Missile Parts

As a part of an extensive tooling effort gearing the Hawk missile system for high production, a large "HP 30" Lapointe horizontal broaching machine was recently put into operation in the Fabrication Department at the Andover (Mass.) Plant, Missile Systems Division of Raytheon Manufacturing Company. This machine is used to perform two critical operations on the Gimbal ring which is part of the antenna and hydraulic assembly of the Hawk missile.

The first operation consists of simultaneously finishing ten surfaces on the ring, holding between 0.002 and 0.004-inch tolerances and a better than 32 surface finish. The total cycle time, including loading, is 2.5 minutes. Formerly, the same surfaces were machined in four operations on vertical type milling machines in a total cycle time of 90 minutes.

The second operation consists of broaching an 8-inch inside shelf and an opposed flat. The same tolerances and finish are achieved in a cycle time of 2.5 minutes. Formerly, these operations were performed on milling machines with a total cycle time of 60 minutes.

By utilizing the new broaching method it is said that the applicable operations on the Gimbal ring are now performed in a total cycle time of 5 minutes where formerly they were machined at 150 minutes, a saving of 145 minutes per piece. In addition, the operations are completed with two setups on one machine instead of seven on three machines. One very important point claimed for broaching is that rejections are fully eliminated and every part is identical and is completely interchangeable.

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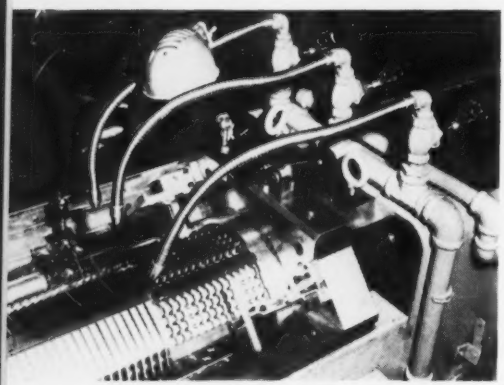
★ modern machine shop ★

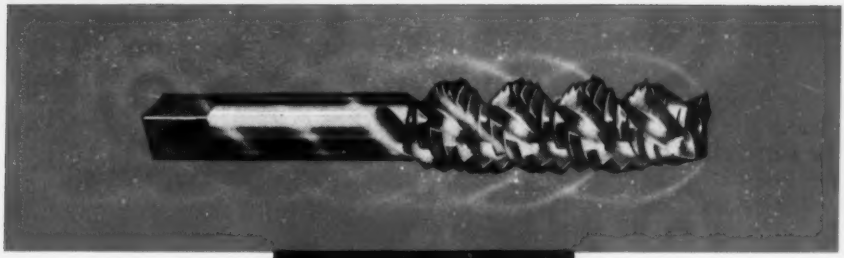


Close-up view of broaching machine, showing the fixture used for holding Gimbal ring while broaching with Lapointe broaches.

Rapid Production of Jet Engine Fuel Nozzles

Finish boring and contouring the inside diameters and contours of small jet engine fuel nozzles is a job demanding the highest precision together with an excellent finish. The accompanying illustration shows an Ex-Cell-O Style 308 cam operated precision boring machine which is performing such an operation at the rate of 184 parts per hour. Material is stainless steel.

Clamped in three-jaw diaphragm chucks, two parts are machined simultaneously. The cycle is initiat-



TURBO-CUT

the tap that's changing the meaning of "high production"

The reports we're getting from our field men on Turbo-Cut Tap performance are self-explanatory.

Here's a sample from one day's mail:

"This tap was run on an aluminum carburetor part and started to run undersize after 32,160 holes."

"We currently have a 5/16-24 Turbo-Cut that is still going after 18 shifts and over 43,000 holes."

"A #10-24 Turbo-Cut plug tap ran 18,200 holes on a zinc die cast job."

Threadwell's Turbo-Cut is piling up records like these daily. Every plant interested in increased production should take a look at the tap that really means "high production". See your threadwell Distributor now for details.

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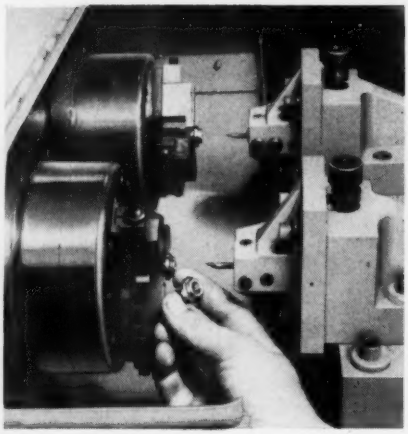
ed by depressing the start button, causing the table to rapid advance. The cam follower engages the table cam and finish boring commences. At the end of the straight section of the bore, coordination of both table and cross slide cams causes the boring tools to follow their predetermined paths and precision generate the inside contour. The 0.003-inch radius boring tools feed over into the 0.022-inch diameter end hole before the table of the boring machine rapids back to the start position.

A surface finish as high as 12 r.m.s. is said to be obtained on routine production.



Close-up of tooling on Ex-Cell-O Style 308 cam operated precision boring machine shows boring tools and small size of part.

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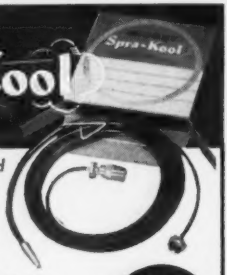
MIDGET



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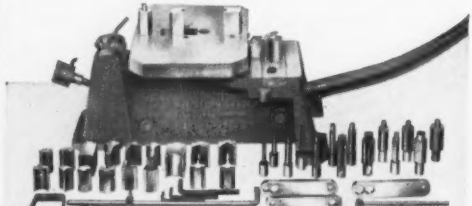

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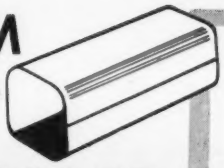

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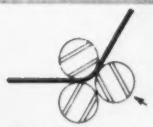
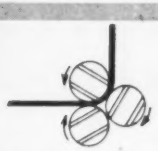
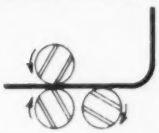
1 Introduce metal with Idler Roll disengaged.



2 Roll thru to desired point and engage Idler Roll.



3 Continue bend until angle is formed.



4 Disengage Idler Roll and roll to next point.

5 Engage Idler Roll to make second bend.

6 Repeat process until shape is formed.

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ideas from readers

ideas from readers

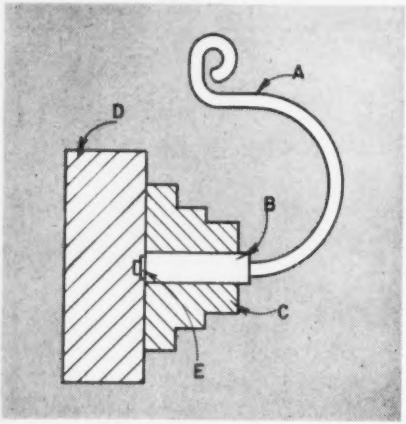
Several time-saving ideas and suggestions for the man in the machine shop.

Lathe Chuck Lifting Hook

By LAURENCE H. SEIBERT

One of the more troublesome tasks to be performed in the shop is the changing of lathe chucks, particularly large ones. The lifting hook shown in the accompanying sketch is designed to facilitate the handling of such chucks while being changed on the lathe.

The hook, *A*, is equipped with a rotating sleeve, *B*, which is gripped by the chuck jaws, *C*, thus permitting the chuck, *D*, to rotate for aligning with the end of the lathe spindle or for easy threading. The sleeve, *B*, is held on the hook by welding a washer, *E*, on the end as shown. The lifting point of the hook is designed to suit the configuration and center gravity of the chuck. With care, one lifting hook can usually be devised which will work satisfactorily for all chucks on one machine or perhaps several machines of similar size. The hook may be made from a single piece of steel or may be built up by welding several pieces of steel together.



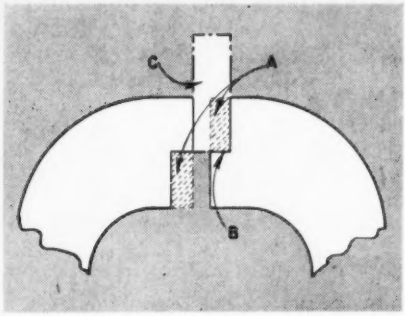
Sketch of handy lathe chuck lifting hook.

★ modern machine shop ★

Undercut Vise Jaws Prevent Marring of Clamped Parts

By F. A. ADAMS

While walking through the shop one day, I noticed a standard bench vise that had been altered to make it considerably more usable for clamping narrow workpieces. The toolmaker had undercut each jaw, as shown at *A* in the accompanying sketch, in order to provide



Sketch showing how vise jaws can be undercut to allow for clamping of narrow parts without marring due to excessive pressure.

a supporting or squaring up ledge, *B*, for clamping the narrow workpiece, *C*. Because of this supporting ledge, workpieces do not have to be clamped quite as firmly as normally required to prevent slippage, with the result that clamping marks are eliminated on the workpieces. For unusually long pieces, a vise with the above mentioned feature may be mounted at each end of the work bench.

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Adjustable Type Work Rest Button for Jigs and Fixtures

By H. J. GERBER

Often when building jigs and fixtures it is necessary to true up hardened work rest buttons upon which the workpiece is seated. In many cases, particularly if the jig

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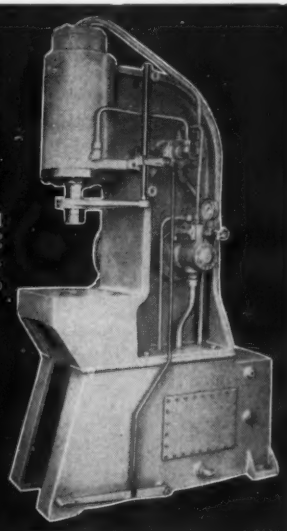
- STRAIGHTENING



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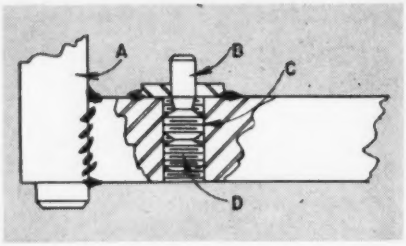
body is of welded construction, it is difficult to reach these locators for surface grinding after assembly. We frequently use the illustrated form of construction in order to eliminate the necessity for grinding this type



Adjustable rest button for jig or fixture.

of locator after it has been fully assembled.

Holes are drilled and reamed through the bottom plate of the jig, *A*, at desired location points to accommodate hardened and ground standard dowel pins, *B*. From the bottom side of the jig each of these holes is tapped part way through to receive a flat point set screw, *C*, which is used to adjust the pin to the correct height.

Checking of the top surface of each dowel pin is usually accomplished with a dial indicator and surface gage while the work is mounted on a surface plate. After the location plane of all pins has been verified, a second set screw, *D*, is threaded firmly against the first screw, *C*, in order to permanently lock the location of the dowel pin, *B*.

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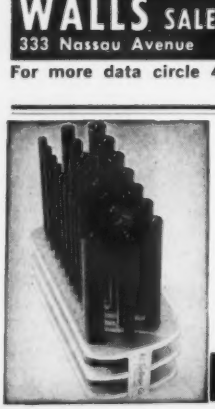

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free literature

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Dressing Fixtures
Form-All Manufacturing Co., Long Valley, N. J. Six page, two color bulletin presents the "Contour Rex," designed for unlimited form dressing on any machine tool grinder.
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Adjustable Stroke Cylinders
Ortman-Miller Machine Co. 19 - 143rd St., Hammond, Ind. Illustrated Bulletin No. 112 covers both air and hydraulic applications for adjustable stroke cylinders. It contains dimensional data and engineering drawings of available mounts and accessories, as well as detailed specifications.
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Thermocouples
Leeds and Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa. Catalog EN-S-2 is newly revised and provides complete information about the company's full line of thermocouples and thermocouple components and accessories.
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Bed Type Milling Machines
Olivetti Corporation of America, 42-33 Northern Boulevard, Long Island City 1, N. Y. This 16 page color catalog gives data on Olivetti FP6-FP9-FP12 Bed Type Milling Machines.
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Amplifier and Power Supply
Seneca Falls Machine Co., Electronics Division, Seneca Falls, N. Y. An electronic servo amplifier and power supply for use in a.c. instrument servo systems is described in this technical data sheet.
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High Temperature Steels
Universal-Cyclops Steel Corp., Bridgeville, Pa. Technical data brochure covering Unimach I and Unimach II high strength, high temperature steels for critical structural applications in airborne vehicles.
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Ram Benders
Wallace Supplies Manufacturing Co., 1804 West Cornelia Ave., Chicago 13, Ill. This 16 page catalog describes a wide range of ram benders, including little ram hand benders, big benders for refineries and other similar industries and the No. 1402 Ram Bender.
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Crankshaft Metalspray Powder
Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. An 8½ by 11, illustrated, two color, engineering data sheet (No. 57) describes Colmonoy C-290 Crankshaft Metalspray Powder.
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Metallizing Handbook
Metallizing Engineering Co., Inc., 1177 Prospect Ave., Westbury, Long Island, N. Y. This flyer describes a comprehensive 320 page volume that covers all phases of modern metal and ceramic spraying. The flyer gives complete information on the book, which is priced at $5.00 per copy.
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C-Clamps
Wilton Tool Manufacturing Co., Inc., Schiller Park, Ill. Four page illustrated condensed catalog describes C-Clamps and gives details of their construction.
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Collet and Chuck Actuators
PowerGrip, Inc., Rockfall, Conn. This four page color bulletin presents the company's new chuck actuator, a non-rotating air cylinder for operating air chucks. Also described is the Model 3A Collet Actuator.
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Heat Treatment of Tool Steels
Uddeholm Company of America, Inc., 155 East 44th St., New York City, N. Y. This 28 page technical booklet is entitled "Modern Principles of Heat Treatment of Steel." It is directed to the metallurgical engineer, tool and die engineer and others involved in the heat treatment of steels.
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Centerless Grinder
Van Norman Machine Co., Springfield, Mass. This eight page color catalog describes and illustrates the Van Norman Number 1-C Centerless Grinding Machine that grinds small parts fast and economically.
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Jig Borers
Pratt and Whitney Co., Inc., 25 Charter Oak Boulevard, West Hartford, Conn. Catalog No. 614 is a 28 page color brochure on end measure jig borers.
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Electronic Tracer
Linde Co., Room 2840, 420 Lexington Ave., New York 17, N. Y. Simple pencil line sketches of intricate shapes and forms can now be used to guide oxygen shape-cutting machines with a new electronic tracer that is described in this booklet.
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Grinding Wheels
Macklin Co., Jackson, Mich. Four page color brochure describes cylindrical grinding wheels. It describes the abrasives and bonds employed for various cylindrical cutting operations. The literature contains cylindrical wheel test records and wheel recommendations for cutting a wide range of metals.
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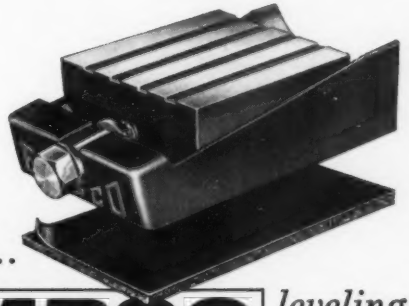

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Nomograph for Milling Cutters
Morse Twist Drill and Machine Co., New Bedford, Mass. Three color chart is a punched, fold out, designed for ringbinder insert that graphically shows cutting standards for circular milling cutters when applied to various metals and plastics.
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Cold Finished Steel Bars
Jones and Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa. The unique physical properties of Jalcase 100, a free machining stress stabilized cold finished steel bar, are explained in this eight page booklet.
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Dust Collector Accessories
Torit Manufacturing Co., Department 714, 1133 Rankin St., St. Paul 16, Minn. Information sheet includes illustrations, drawings and specifications on dust collector accessories.
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Electric Vibrators
Syntron Co., 309 Lexington Ave., Homer City, Pa. This 12 page catalog concerns pulsating - magnet electric vibrators for keeping stubborn bulk materials and bulk parts free flowing from bins, hoppers and chutes.
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Universal Die Base
Wales - Strippit, Inc., 207 Buell Road, Akron, N. Y. Catalog describes a new type of die base for Strippit Type CJ Hole Punching Units, which cuts replacement cost of round and shaped dies by approximately 50 percent.
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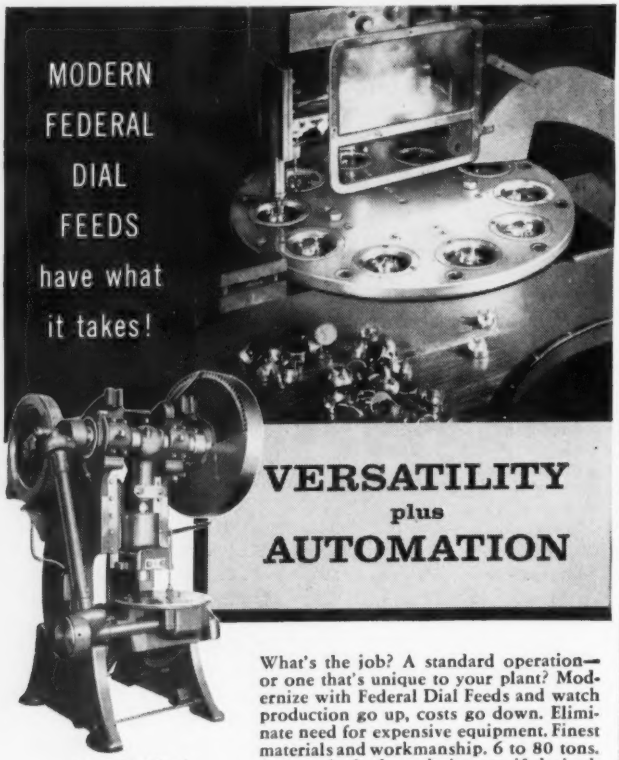

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Homestrand, Inc., 9 Addison St., Larchmont, N. Y. Brochure describes the Malcus Universal Toolholder for 16 inch or larger lathes.
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Replacement Analysis Manual
Heald Machine Co., Worcester 6, Mass. The broad purpose of this manual is to call attention to the importance of a planned replacement program. The immediate purpose has been to provide industry with a tool which can be used to better appraise machinery replacement from a very sound investment standpoint.
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Boring Bars
Giddings and Lewis Machine Tool Co., Davis Division, Fond du Lac, Wis. A new system of listing and pricing the individual elements of a boring bar has been developed by the company. It enables users of Davis Catalog D-520 to secure custom arranged bars at standard prices.
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Air Motors
The Bellows Co., Department MMS 959, Akron 9, Ohio. "A Panorama of Production Ideas" is a 16 page brochure that gives examples of ways that Bellows Air Motors and other "Controlled Air Power" work units are used to cut costs, increase productivity per machine and per man hour, improve quality, reduce scrap and prolong tool life.
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Babcock and Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Data Card TDC-195 describes in detail the properties of Croloy 25-20—its chemical composition, size ranges and short time high temperature tensile and rupture properties.
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Titan Metal Manufacturing Co., Bellefonte, Pa. Eight page folder gives complete sizes, pounds per foot and alloy specs for brass, bronze and nickel-silver rectangular and square bars.
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Heat Treating Units
Ipsen Industries, Inc., 721 South Main St., Rockford, Ill. "The Facts on the New Ipsen Heat Treating Units" is the title of a new six page technical bulletin.
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Replacement Formula
Jones and Lamson Machine Co., 512 Clinton St., Springfield, Vt. Second revised edition of a booklet that describes the Jones and Lamson "Avoidable Costs" Replacement Formula, an improved method for appraising the productivity of machine tools and similar capital equipment.
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Gears
The Adams Co., 1942 Cypress St., Dubuque, Iowa. Circular No. C-110 — "Eliminating Gear Failure in Existing Designs" and Circular No. C-109 — "The advantages of the new 20 degree P. A. system over the old 14½ degree P. A. standard."
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Laboratory Ovens
Despatch Oven Co., 619 Southeast Eighth St., Minneapolis, Minn. Flyer 203-1 completely describes and illustrates the company's Model V-29 Saf-T-Bilt electrically heated laboratory ovens.
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Sine Tools
Bald Eagle Products Division, 356 Cedar St., St. Paul 1, Minn. This four page brochure describes and illustrates the company's compound angle sine plate, hinged sine plate, sine bars and plates and compound angle permanent magnetic sine plate.
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Compressed Air Fundamentals
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. Informative booklet was designed to assist anyone in the selection of a small packaged air compressor for either automotive or industrial application.
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Forgings
Bridgeport Brass Co., 30 Grand St., Bridgeport, Conn. Technical bulletin on phosphor bronze rod, which is particularly adaptable to applications requiring corrosion resistance, strength, electrical conductivity, anti-frictional properties, low temperature performance or non - magnetic characteristics.
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Testing Equipment
Custom Scientific Instruments, Inc., Kearny, N. J. Catalog No. 59A describes 73 units, such as abrasion testers, biological and scientific equipment, flammability - ignition testers, production, control and research equipment and so on.
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Optical Jig Borer
Amitool Co., Inc., 629 Main St., Westbury, Long Island, N. Y. Catalog No. 160 gives complete data on the Omega Optical Jig Borer with a table surface of 24 by 16 inches.
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Safety Products
Bausch and Lomb Optical Co., 893 St. Paul St., Rochester 2, N. Y. This 40 page catalog includes descriptions of plastic, metal and combination safety glasses,

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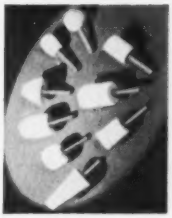
If you have a tough polishing, buffing, lapping or de-burring finishing problem where tolerances must be held close, solve it by putting a Paramount Bob on the job. Seven custom shapes, 42 sizes, four degrees of hardness from soft to rock hard — there's a Paramount Bob ideal for every close-quarters precision finishing job. For example:



MICRO-FINISHING
Paramount Felt Bobs make ultra-fine finishing of surfaces quick, easy and economical.

DIE AND MOLD MAKING
Thousands of die and mold makers depend on Paramount Bobs to perform precision finishing and buffing operations. Ideal for removing burrs without destroying close tolerances.

NEW BOB ASSORTMENT KITS

K-1 Assortment includes 24 mandrel mounted bobs, 36 small wheels, touch-up pads — 66 pieces all together — packaged in one convenient bench top box. (K-2 Assortment also includes four sticks assorted polishing compounds.)

These handy assortments provide bobs of just the size, shape and hardness you want — and at $10.95 (K-1) and $12.95 (K-2) they are far below the cost of buying bobs separately.

See your jobber or write for literature

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free literature . . .

specially designed goggles and eye shields. It gives complete specifications for Bal-Safe lenses and the Enduron plastic lenses.
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Relief Valves
Double A Products Co., Manchester, Mich. Data Sheet No. C-8925 describes a pipeless hydraulic pilot-operated relief valve, the Model BTP-175. This valve was designed to be sandwiched between directional valve and subplate, eliminating all extra relief valve piping.
For more data circle 45 on Postpaid Card

Toolholders for Turret Lathes
Gahr Machine Co., 19199 St. Clair Ave., Cleveland 19, Ohio. Data sheet on adjustable flanged toolholders for popular makes of turret lathes.
For more data circle 46 on Postpaid Card

Straight Side Presses
K. R. Wilson, Inc., Arcade, N. Y. Bulletin 5-B gives both illustrations and details of the recently modernized KRW Straight Side, Single Action, Hydraulic Press Line, which has been expanded to include a size range of 25 through 1,000 tons.
For more data circle 47 on Postpaid Card

Toolholders
Firth Sterling, Inc., 3113 Forbes Ave., Pittsburgh 30, Pa. Catalog MTI-5 is an 18 page brochure, which presents the company's new line of mechanical toolholders and throw away inserts.
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Shears
Beverly Shear Manufacturing Co., 3000 West 111th St., Chicago 43, Ill. Catalog CC-159 provides complete and detailed information on the following products: pneumatic shear, inside slotter, slitting shear and electric throatless nibbling shear.
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You can do
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Get your FREE Sketch Pad for easy, exact selection.

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Lubricants
Chicago Manufacturing and Distributing Co., 1910 West 46th St., Chicago 9, Ill. This four page color bulletin gives complete information on the company's CMD Anti-Scoring Lubricants that are both concentrated and stabilized for high production.
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Air Gage System
Federal Products Corp., 9144 Eddy St., Providence 1, R. I. Catalog No. 59D contains 32 pages devoted to the Dimensionair one master air gage system. Information on various attachments and accessories is provided.
For more data circle 51 on Postpaid Card

Bar Machines
National Acme Co., 183 East 131st St., Cleveland 8, Ohio. This 44 page Catalog MSB-59 fully illustrates and describes the company's complete line of multiple spindle bar automatics.
For more data circle 52 on Postpaid Card

Profiling Machines
George Gorton Machine Co., 1706 Racine St., Racine, Wis. Bulletin 2972 describes and illustrates the Auto-Trace Electro - Hydraulic Series production profiler with 360 degree automatic tracer.
For more data circle 53 on Postpaid Card

Vibration Control
Barry Controls, Inc., 783 Pleasant St., Watertown 72, Mass. Bulletin 59-05 briefly explains the various applications for machinery mounts.
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Socket Screw Standard
Standard Pressed Steel Co., Box 556, Jenkintown, Pa. Extensive specifications and application data for a new socket screw standard—the large diameter head socket head cap screw—is provided in this four page technical bulletin.
For more data circle 55 on Postpaid Card

Boring and Facing Tools
Comet Tool Co., 738-M8 Broadway, New York 3, N. Y. Six page brochure features a complete line of precision boring, facing and internal threading tools.
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MODEL JA
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IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

THE SPEED of Kipp Featherweight Air Grinders stays up where it belongs, under load, for efficient grinding even with small wheels. This may not be true with most of the "Plug-In" grinders you now are using.

HAVE YOU GIVEN your toolmakers a chance to save valuable hours by providing them with enough Kipp Featherweight Air Grinders and accessories?

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Portable Broaches
California Broach Co., 664 South Anderson St., Los Angeles, Calif. Flyer describes and illustrates precision portable broaches designed for fixed or portable machines.
For more data circle 57 on Postpaid Card

Safety Cup Wheels
Carborundum Co., Niagara Falls, N. Y. "Built-In Guard" safety cup wheels which have been designed for portable grinding in steel mills, foundries and welding shops are the subject of this new two color folder.
For more data circle 58 on Postpaid Card

Marking Equipment
The Acromark Co., 9 Morrell St., Elizabeth 4, N. J. Section E provides information on special purpose manual and power operated Acroleaf Presses.
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Large Precision Machining
Done to your specifications
We have 22 Jig Borers
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Need help machining stainless steels? Armco machining engineers have compiled several booklets, a complete manual, and a special film to help you increase your profits on stainless jobs. For a list of available literature on machining or complete information on specific grades of stainless steel, just write Armco Steel Corporation, 3089 Curtis Street, Middletown, Ohio.

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news of the industry

news of the industry

Product acquisitions . . . new processes . . . plant tours . . . new plants and expansions . . . officers.

Edited by L. L. BALDHOFF

NEW VACUUM PROCESS FOR STEEL

A new method of producing clean, tough steel for industry's most difficult metalworking jobs, such as for die blocks and forgings, was recently demonstrated by A. Finkl and Sons Company, a Chicago steel maker. This new process removes hydrogen gas, which causes microscopic cracks, from molten steel in the ladle on a regular production basis. Oxygen and nitrogen gases are also removed by the process to make cleaner, better steel.

In production, a 75,000 pound batch of steel is poured from the electric furnace into a ladle. The ladle is then placed inside a large vacuum degassing chamber and the cover put in place. Then the vacuum degassing cycle is started. Four steam ejector suction pumps are turned on in proper sequence by automatic controls. The air inside the chamber is drawn out, creating a high vacuum inside.

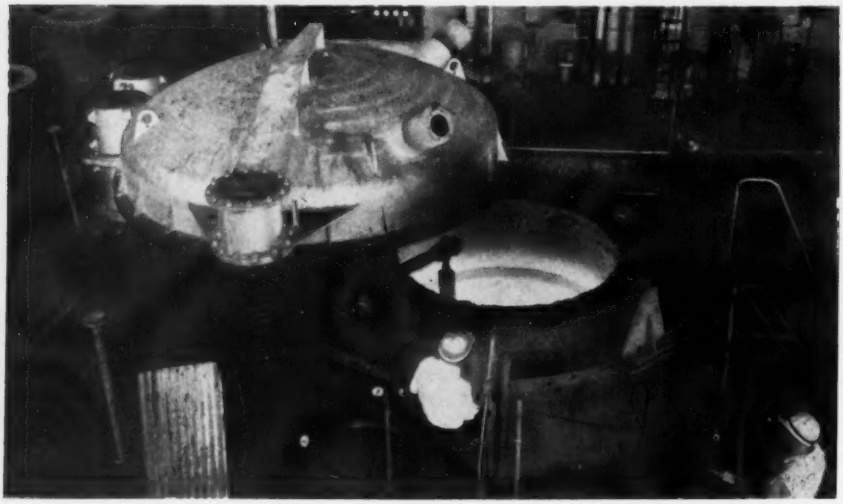

Illustration showing the quiet surface of the steel in the ladle immediately after the steel has been vacuum degassed by means of the newly developed Finkl Vacuum Process.

As the vacuum is achieved, the microcrack-causing hydrogen gas that is in the steel, bubbles to the top and is subsequently drawn out of the chamber. Oxygen and nitrogen gas also bubbles up and out of the chamber.

The rolling turbulent action is increased as helium gas is injected into the steel in the ladle. Helium also serves as a scavenger in order to increase the vacuum removal of unwanted gases. The company's test sheets show that the amount of hydrogen removed drops from an average of 3.9 parts per million down to 1.5, which shows that 60 percent of the hydrogen has been removed—an extremely desirable accomplishment.

The vacuum degassing cycle in the ladle takes approximately 12 minutes; the steel loses very little temperature, which is important. Production records show that vacuum degassed steel is poured into the ingot molds at about 2,850 degrees. The company has also found that degassed steel can be poured at approximately 30 degrees lower than non-degassed steel.

DREIS AND KRUMP EQUIPS NEW BUILDING

Dreis and Krump Manufacturing Company, Chicago, Illinois, now has its new factory addition in operation. The building has two new, large horizontal boring machines and two new, wide table, high speed planers. The 15,000 square feet will be used for machining and assembly of the larger mechanical press brakes and, also, the new line of hydraulic press brakes.

Aget offers more! Over 38 standard Dustkop models to choose from . . . *Plus* engineering service to help you select, provide, and install the proper accessories and fittings to complete your dust collecting system. Write for illustrated folder . . . Today!

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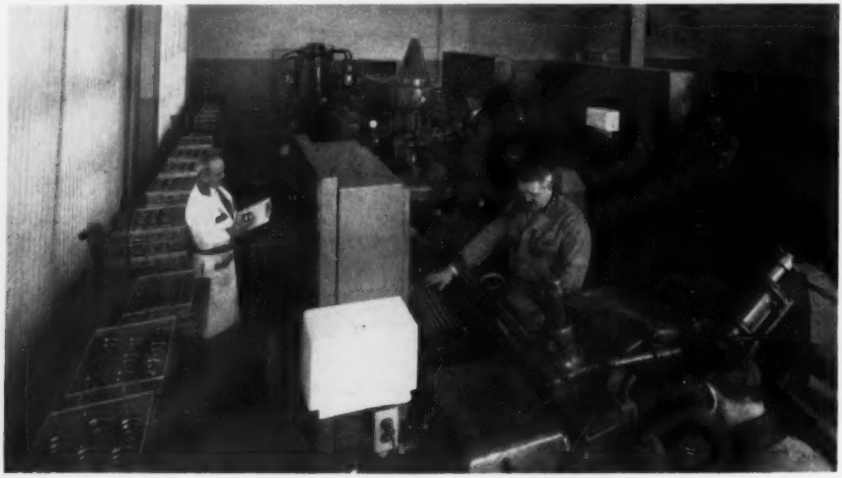
news of the industry . . .

NORMAN-HOFFMANN BEARINGS CORPORATION OPENS SHOWPLACE OF PRECISION

A specially designed "add-on plant" for manufacturing ultra-precision angular contact bearings is now in operation at Norma-Hoffmann Bearings Corporation, located in Stamford, Connecticut.

Designed and built by the company's own engineering and operating personnel, the new facility is capable of producing more than a million dollars in high precision bearings annually. The air conditioned and humidity controlled facility contains the most modern machinery, methods and instruments available to the bearings industry, according to Richard D. Robertson, vice president in charge of manufacturing.

Among the unique or unusual practices claimed for the new facility are: controlled environment, with full air temperature, humidity and dust control of all ultra-precision manufacturing operations; super-accurate new universal preload grinding techniques with automatic in-cycle gaging to prevent over-grinding; precise in-process inspection at each machine to measure work as closely as 0.0000025 inch, which controls race-to-face dimensions to such an extreme that only one variable is present when matched races are preload ground; specially designed new honing equipment which affords a lower micro-inch finish than ever before obtained; single cycle rough and finish internal grinding with special hydraulic clamping to reduce the number of chuckings per part; deep freezing of stock after heat treatment to control dimensional stability and hardness; constant temperature coolant—within 2 degrees of room temperature and with impurities down to 3 microns removed—to minimize thermal expansion of work and allow gaging immediately after grinding; and centralized services with all coolant lines located in a subsurface utility room to provide uncluttered overhead area, which promotes efficiency and facilitates quality type workmanship.



Ultra precision grinding area in the new Norma-Hoffmann Showplace of Precision

MICROMATIC HONE ADDS GRINDERS TO ITS LINE OF PRODUCTS

Micromatic Hone Corporation, Detroit, Michigan, recently announced that it is the exclusive sales and service source in the United States and Canada for grinding machines manufactured by its associate company, A. A. Jones and Shipman, located in Leicester, England.

Jones and Shipman has been building and selling Micromatic honing equipment overseas since 1950. This close association between the two companies resulted in the decision to link the Jones and Shipman line of toolroom grinders to Micromatic coverage. Micromatic now offers industry machines for performing such operations as precision grinding, toolroom grinding, cutter and tool grinding, surface grinding and so on.

★ mms ★

IBEC TO ERECT PLANT IN ARKANSAS

Plans to erect a new manufacturing and assembly plant in West Memphis, Arkansas, have been announced by The Bellows Company, Valvair Corporation and Sinclair-Collins Valve Company, all of Akron, comprising the Fluid Power Divisions of International Basic Economy Corporation (IBEC). The three companies, of which Herbert B. Link is president, manufacture and distribute pneumatic, hydraulic and electrical components for industrial applications in automating metalworking, textile, plastic and other manufacturing processes.

The new plant, which will facilitate distribution in the South, will be of

FREE WALL CHART
MARSHALL
PRECISION
Ground Flat Stock
5 KINDS
THE ARISTOCRATE OF GROUND FLAT STOCK
SPECIAL SIZES FURNISHED ON REQUEST—SPECIFY MARSHALL PREPARED TOOL STEELS
COMPETITION
BRINGS OUT THE BEST IN EVERY COMPANY
MARSHALL STEEL COMPANY specializes in the production of Ground flat tool steel, Drill Rod and allied products. Since 1945 Marshall Steel Co., has grown to FIRST PLACE in the production of velvet finish ground flat tool steels.
DID YOU KNOW THAT...
Marshall was FIRST to produce wide sizes.
First to produce thicknesses over ½ inch.
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FIRST to furnish 5% chrome Air Hardening steel in finished ground form.
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FIRST to manufacture LOW CARBON 1018 steel for applications not requiring hardening.
FIRST to safety wrap in Aluminum Lined rustproof wrappings.
LEADERSHIP—often copied—never equaled!
This is why—Marshall Steel Company has grown to be the largest producer of Ground Flat Tool Steel.
FOR YOUR CONVENIENCE write for colorful wall chart with all sizes and grades.
We invite comparison—write for complete catalog of products.
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steel, brick and concrete construction and will be located on a five acre plot. Initial construction will cover about 20,000 square feet of floor space. More than 100 persons are expected to be employed when the plant is in full operation.

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GIDDINGS AND LEWIS ESTABLISHES MANUFACTURING OPERATIONS IN SCOTLAND

Giddings and Lewis Machine Tool Company, Fond du Lac, Wisconsin, and Douglas Fraser and Sons, Limited, Arbroath, Scotland, have announced the formation of a British company named Giddings and Lewis-Fraser, Limited, with G .and L. owning the controlling interest. It was stated that this new company was formed in order to enable G. and L. to compete more favorably in the sale of its products in world markets.

Also announced were changes in the executive staff of Giddings and Lewis. Morton R. Swift has been appointed vice president-foreign operations. George J. Becker has been appointed treasurer, controller and assistant secretary, succeeding Mr. Swift as the principal financial officer.

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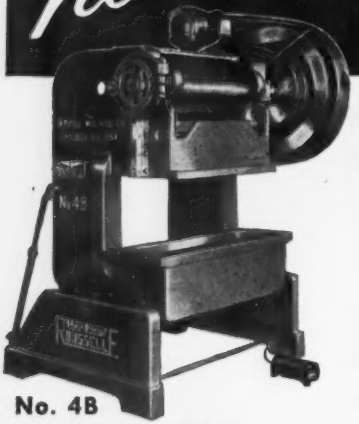
SYNTRON COMPANY NAMES NEW OFFICER

Byron K. Hartman has been appointed executive vice president and general manager of Syntron Company,

New 40-TON DOUBLE CRANK O. B. I.
ROUSSELLE



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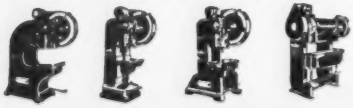
ROUSSELLE PRESS

WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
- Bronze main and crank bearings.

CHOICE OF 30 SIZES AND TYPES IN 5 TO 40-TON PRESSES



SERVICE MACHINE CO.
Mfrs. of Rousselle Presses
2310 WEST 78th STREET • CHICAGO 20, ILL.

ROUSSELLE PRESSES ARE SOLD EXCLUSIVELY THROUGH LEADING MACHINERY DEALERS
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Homer City, Pennsylvania, manufacturer of vibratory materials handling equipment and electronic devices and equipment. It is a subsidiary of Link-Belt Company.

Mr. Hartman, who has been sales manager of Link-Belt's Colmar plant near Philadelphia, has been with the parent company since 1937.

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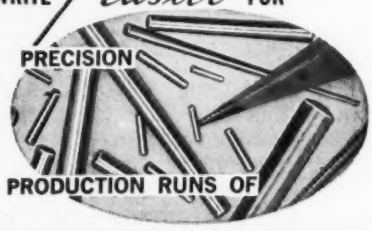
YUGOSLAV EXECUTIVES TOUR ADAMAS CARBIDE PLANT

High ranking Yugoslavian tool engineers and tool designers visited the Adamas Carbide Corporation plant in Kenilworth, New Jersey, to study the designing and production techniques used by Adamas in the manufacture of cemented tungsten carbides, carbide tools, tool tips, dies and wear parts.

The group—composed of eight men and one woman from various Yugoslavian companies which manufacture agricultural equipment, construction equipment, industrial machinery and machine tools—made a guided tour of the modern, award-winning plant accompanied by a U. S. State Department interpreter and an escort from the International Cooperation Administration, which arranges such projects for the U. S. State Department.

Edward L. Dreyer (center), president of Adamas Carbide Corporation, Kenilworth, New Jersey, welcomes a special Yugoslavian "study team" of mechanical engineers.

WRITE Peaslee FOR PRECISION PRODUCTION RUNS OF



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DIAS. 9/0 to #4

As specialists in stainless-steel, instrument-type pins, we offer quantity runs of standard size Taper Pins. Tolerances are held to .001 on dia. Sizes run from #4 down to 9/0. Send your blueprints for prompt quotation.

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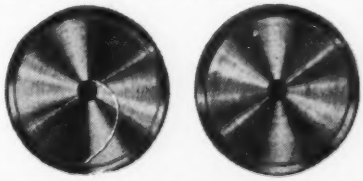
Troubled by Withdrawal Marks?

the new RELIEVOMATIC*, saves you costly refinishing!

No more rejects or refinishing because of marred surfaces made by cutting tools on their return pass! Now—the RELIEVOMATIC renders precise parts with perfectly smooth surfaces. For boring, turning or facing on automatic metal turning equipment.

Write for complete technical literature.



normal marred surface | perfectly clear surface with RELIEVOMATIC!

*U. S. Patent No. 2,712,767

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Nightingale 9-8600

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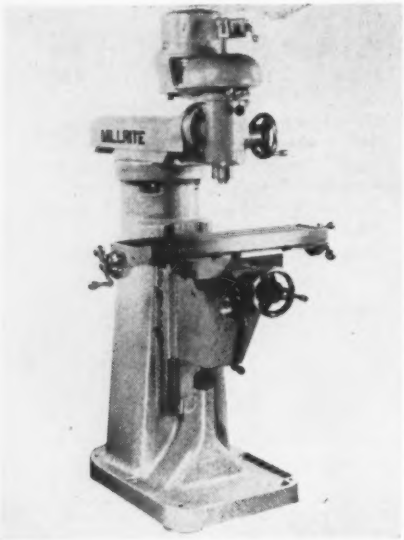
new shop equipment

new shop equipment

Descriptions of new machines, tools and materials for metalworking.

VERTICAL TOOLROOM MILLER HAS LARGE RANGE AND CAPACITY

A vertical toolroom milling machine that has the range and capacity of larger mills has been developed by The U. S. Burke Machine Tool Division, Brotherton Rd. at Pennsylvania R.R., Cincinnati 27, Ohio. The Millrite is built accurately and ruggedly to accepted machine tool tolerances. As a result, it is highly productive for both precision milling and boring operations.



The Millrite Vertical Toolroom Miller

Equipped with a swivel head, the Millrite is capable of angular, as well as vertical, operations. The ram and turret machine has a 7 by 27 inch table with longitudinal feed of 16 inches, crossfeed of 8 inches, vertical feed of 15 inches and ram movement of 12 inches. The quill travel is 4 inches.

Maximum distance from the spindle nose to the face of the column is 16 inches; maximum distance from the nose to the top of the table is 18 inches.

A special feature is the "Feather Feed" of the quill, utilizing the inherent accuracy and smoothness of a lead screw and nut arrangement. The manufacturer claims that this feature is particularly advantageous for precision boring.

New type vee belt drive transmits full power of the ¾ h.p. motor at all six spindle speeds, from 250 to 3,450 or alternately 185 to 2,550 revolutions per minute. Belt positions may be set with one hand.

For more data circle 60 on Postpaid Card

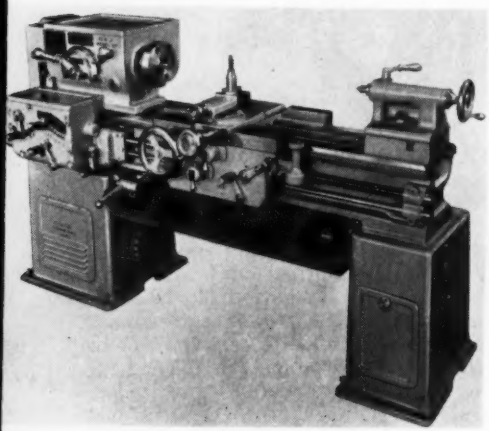
and shop materials

Edited by L. L. BALDHOFF

GEARED HEAD ENGINE LATHE

The Carroll-Jamieson Machine Tool Co., Dept. 9, Batavia, Ohio, announces a 16 inch geared head engine lathe. This Master Model GH 16 inch features big lathe performance at considerable economy.

The 5 h.p. motor is conveniently mounted in the cabinet leg with multiple vee belt drive to headstock vee pulley. The all geared headstock is designed for convenience, power and durability with 12 spindle speeds, ranging from 20 to 900 r.p.m. obtained through two speed handles. Accurately ground steel shafts and heat treated alloy steel gears are provided. A standard LO type taper nose spindle, or an optional threaded nose spindle, is mounted in precision Timken taper roller bearings.



Master Model GH 16 Inch Geared Head Lathe

An improved friction type clutch and brake affords instantaneous spindle control, allowing the motor to run continuously. Lubrication of the headstock is by splash system, the parts running in a constant oil bath. A quick change gearbox is furnished with 48 separate threads and feeds. Threads 3 to 184 per inch are available through the gearbox levers. A quadrant accommodates gears to cut special threads. A clutch lever controls lead screw and feed rod, which cannot be engaged together. A neutral position is also provided, disengaging both screw and rod. The double wall apron employs all steel and ductile gearing. Separate lever type longfeed and crossfeed positive clutches are supplied. The reverse mechanism for both feeds is operated by a conveniently positioned lever. A separate rod is used for the feed; lead screw is used only for thread chasing. An interlocking device prevents the engagement of the lead screw unit and clutch feed simultaneously.

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HIGH VOLUME AUTOMATED PRECISION BORING

The automated Style 112-D Precision Boring Machine, that handles over 260 automobile transmission parts every hour, is announced by Ex-Cell-O Corp., Detroit 32, Mich. The automatic cycle includes assembly, loading, precision boring and unloading.

An automatic assembly unit presses a bronze bushing into the cast iron body of the component. The bushings are gravity fed from a hopper, while the cast iron bodies, as received from a conveyor, are rolled into the assembly station, again by gravity. The bushings are pressed hydraulically into the bodies and two body-and-bushing assemblies are completed at each cycle.

An automatic loading mechanism transfers assemblies to the machine chucks. Here a finish precision boring operation is performed on the bushings, before the parts are automatically unloaded and passed to a gaging station at the rear of the machine.

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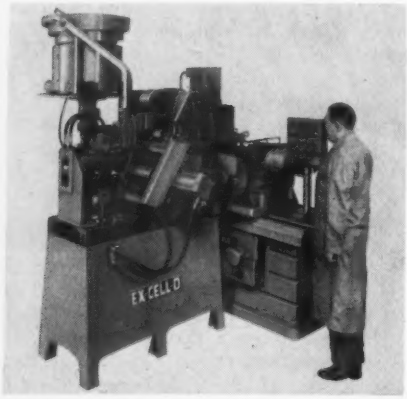
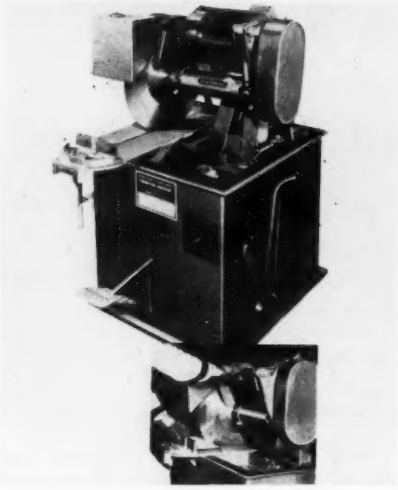


Ex-Cell-O Style 112-D Boring Machine



The Promacut Multi-Purpose Cut-Off Saw

CUT-OFF SAW SLICES STEEL WITHOUT CLAMPING OR HOLD-DOWN

Production Machinery, Inc., P. O. Box 322, Oakton Station, Des Plaines, Ill., announces the Model 8A Promacut Multi-Purpose Cut-Off Saw. Unique engineering and design permits cutting all shapes of carbon, alloy and stainless steel at high speeds without clamp-down, coolants or loss of control.

The secret of the Promacut lies in the special alloy saw blade and precisely engineered cutting angle. The combination of these produces a semi-milling action, rather than a scraping or abrasive action. Result is a smooth, practically burr-free cut without any drag. The blade cuts so fast, the stock cannot absorb heat to change temper. Thus, no coolants are necessary. With drag and heat eliminated, no clamping or hold-down devices are needed. Cuts can be made with the stock just lying on the cutting table.

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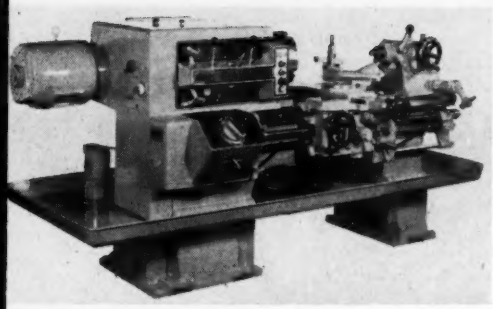

Clearing-Axelson Series 2013 Engine Lathe

HEAVY DUTY ENGINE LATHE IS REDESIGNED

Clearing Division, U. S. Industries, Inc., 6499 West 65th St., Chicago 38, Ill., has made major modification on its standard Series 2013 Clearing-Axelson Lathe.

Important changes include boosting the motor horsepower, increasing spindle speeds and enclosing the gear box. Greater horsepower enables the machine to maintain its high degree of precision on heavier cuts, so that users benefit in improved productivity. Its increased speed range makes it possible to machine many types of materials at optimum turning speeds with the latest types of tooling. The gear box enclosure insures better lubrication and the elimination of foreign materials in the gear train.

Although designated as a 2013 Lathe, the actual swing over the bed on this machine is 22½ inches; swing over carriage is 13¾ inches.

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★ modern machine shop ★

HONING MACHINE HAS COMPACT DESIGN AND SIMPLICITY OF CONTROLS

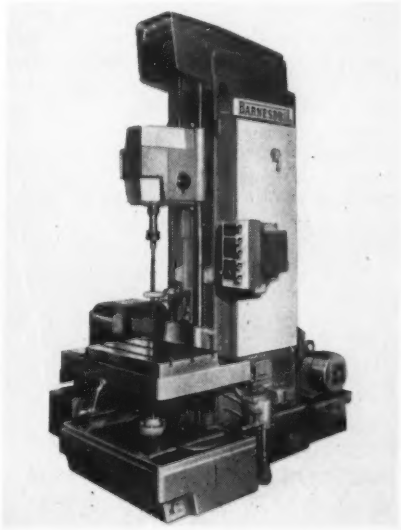
A completely new honing machine, designed to hone bores ranging from ½ to 6 inches in diameter, is introduced by Barnes Drill Co., 860 Chestnut St., Rockford, Ill. Features of the Model 244 are its compact design and the simplicity of its controls. The BarnesdriL Plugmatic bore-to-bore sizing unit maintains size consistency within 0.0002 inch from bore to bore on this machine.

An electric hone expansion unit gives infinite hone feed adjustment without tubes and rectifiers. Rapid expansion, rapid collapse and automatic compensation for stone wear are electrically controlled.

The machine is available with one or two spindles in a choice of three stroke lengths.

A 30 gallon coolant reservoir is an integral part of the machine base. A 5 h.p. motor provides power for the spindle drive through a vee belt, and hydraulic reciprocation is powered by means of a separate 3 horsepower motor. Overall floor dimensions are 40 by 86 inches.

For more data circle 65 on Postpaid Card



BarnesdriL Model 244 Honing Machine

Lennox No. TE-100 Bench Model Metlmastr

SHEARING AND FORMING MACHINE FOR BENCH WORK

With only five moving parts, the Bench Model TE-100 Metlmastr is the newest in the Tru-Edge line of shearing, forming and piercing machines built by Lennox Tool & Machine Builders, Dept. 154, Lima, Ohio.

The bench model with an edge cutting capacity up to 12 gauge in mild steel plate and 16 gauge in stainless steel is equipped with a ½ h.p., 110 volt, single phase motor. It has a variable stroke length that can be adjusted from 0.022 infinitely through 0.110 without stopping the motor. The operator merely sets the stroke pointer at gage indicated on scale and the Model TE-100 is ready for use.

The Model TE-100 is portable; it can be transported from job to job. It operates on 110 volt, 60 cycle, alternating current.

For more data circle 66 on Postpaid Card

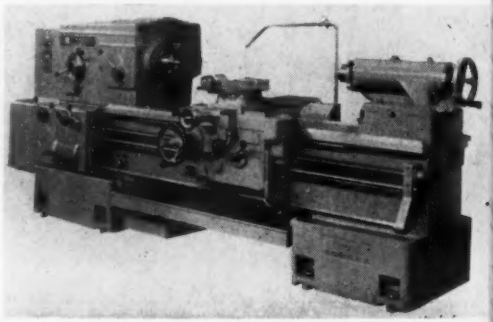
HEAVY DUTY ENGINE LATHE PROVIDES PRECISION MACHINING

More and higher spindle speeds are provided by an entirely new heavy duty engine lathe, announced by Nebel Machine Tool Corp., 3409 Central Pkwy., Cincinnati 25, Ohio. The Model HD 2516 Lathe offers precision machining capabilities for turning and facing a wide variety of heavy duty work. Eighteen gear driven speeds are simply selected from a direct reading color index, and easily controlled by two levers and color keyed speed plates. Speeds up to 1,500 r.p.m. are available with selective gear design engaging only the gears required. The heavy duty headstock design provides wide-faced, shaved and hardened gears, with short, heavy, multi-splined shafts mounted on the anti-friction bearings.

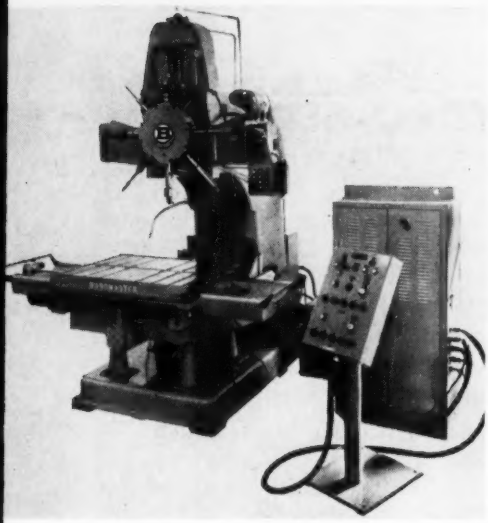
The lathe features heavy duty design throughout. The rugged three-bearing spindle is mounted at the front and center supports on zero precision, angular tapered roller type bearings, preloaded and adjusted for maximum radial and thrust loads. At the rear, the third bearing, radial type, provides for longitudinal spindle expansion. The spindle itself is an alloy steel forging, completely ground, with hardened nose.

Up to 20 h.p. is supplied by a constant speed main drive motor through a multiple disc clutch and brake, that is mounted externally on the headstock for ease of maintenance and adjustment.

For more data circle 67 on Postpaid Card



The Nebel Model HD 2516 Engine Lathe



Turret Drill with hydraulic feed control

HYDRAULIC FEED CONTROL FOR TURRET DRILLING MACHINES

The Burg Tool Mfg. Co., 15001 South Figueroa St., Box 311, Gardena, Calif., announces an improved hydraulic feed for its Models 2 BH and 3 BH machines. The system compensates for temperature variations that normally affect feed rates when hydraulic systems are employed. The temperature-compensated oil flow control will maintain constant feed rates under normal operating conditions.

Feed rates can be dial calibrated and a setting can always be made reliably. Actual feed rate corresponds with feed rate setting; that is, the desired rate of feed, within normal temperature ranges. No hydraulic warm up time is required, feed selection is simplified and the chances of reaching an erratic feed setting are greatly minimized.

Positive feed rate control, which is unaffected by temperature variations, extends tool life by maintaining optimum feed rate for a particular tool and material and maintains accurate depth control.

For more data circle 68 on Postpaid Card

★ modern machine shop ★

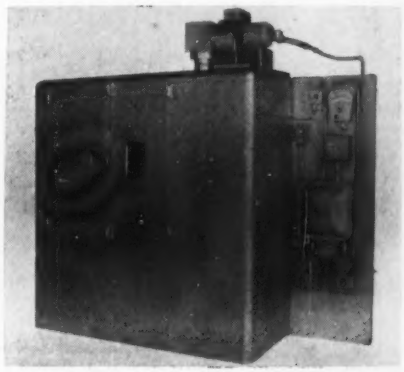
LABORATORY OVEN OFFERS ACCURATE TEMPERATURE CONTROL TO 850 DEGREES F.

Despatch Oven Co., 611 Southeast Eighth St., Minneapolis, Minn., announces a totally new design in its Saf-T-Bilt oven line. This includes: improved shape and sizes for industrial laboratory use, more efficient direction of air flow in the work chamber, accurate temperature control throughout work chamber and new safety controls to enlarge its usefulness in laboratories.

The oven is electrically heated. It can, also, be adapted to use steam or hot water at available pressures.

Two swinging doors provide an oven aperature 37 by 37 inches for easy fast-loading. A heavy duty observation glass window is inserted in one door.

For more data circle 69 on Postpaid Card

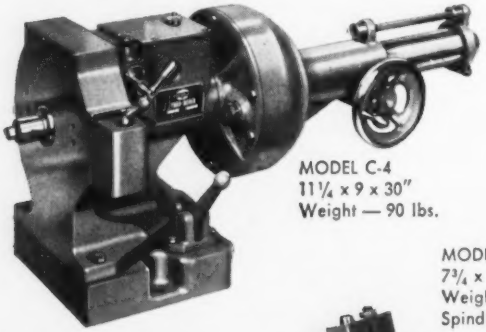


The Despatch Saf-T-Bilt Laboratory Oven

GREENLEE HYDRO-BORERS

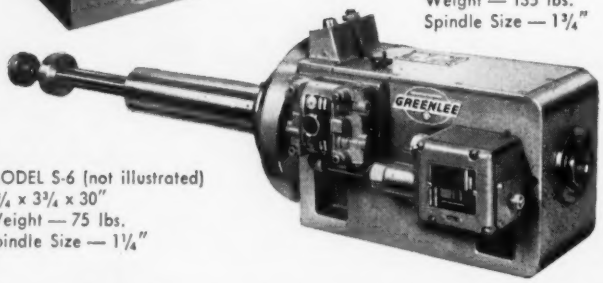
Low cost precision boring

Patented oil displacement feed principle assures high quality finish. Compact design. Ideal for mounting in any position on work-holding fixtures, assembly jigs, etc. Simplifies production setups. Three models to meet all your requirements. Write today for further information.



MODEL C-4
11¼ x 9 x 30"
Weight — 90 lbs.

MODEL S-7
7¾ x 5½ x 34½"
Weight — 135 lbs.
Spindle Size — 1¾"



MODEL S-6 (not illustrated)
6¾ x 3¾ x 30"
Weight — 75 lbs.
Spindle Size — 1¼"

GREENLEE BROS. & CO.
1794 MASON AVENUE
Rockford, Illinois

For more data circle 446 on Postpaid Card

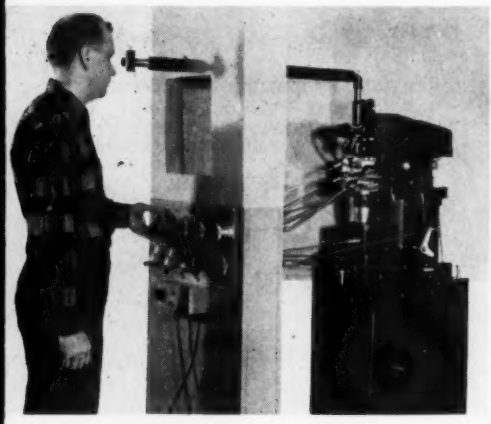
MICROHARDNESS TESTER IS REMOTELY CONTROLLED

Designed for shallow indentation hardness testing of hot metals or metal components that have been exposed to radio active or nuclear energy contamination, a remotely controlled Tukon Tester has been developed by Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., 230-G Park Ave., New York 17, New York.

Used as a research tool for the study of surface conditions, the device is capable of performing extremely accurate and sensitive microhardness tests of small precision parts, thin metals and superficially hardened surfaces.

Vertical capacity of the unit is 5 inches without the Microton mechanical stage and 3½ inches with the stage. Units can be furnished to accommodate test pieces up to 8 inches in height.

For more data circle 70 on Postpaid Card



Remote Controlled Microhardness Tester

Standard Mist-Air-Rester Mist Collector

COMPLETE LINE OF MIST COLLECTORS

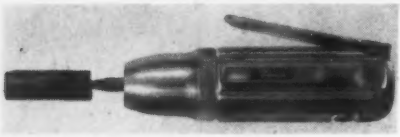
The Standard Electrical Tool Co., 2487 River Rd., Cincinnati 4, Ohio, announces a complete line of Mist-Air-Rester Mist Collectors. These are offered as an accessory for electrolytic spindles and for other applications of electrolytic and wet machining, such as tool grinders, centerless grinders, wet grinders and others where mist or fog is detrimental.

"In-corner" mounting without loss of efficiency is provided for in this flexible design and an alternate design allows for ceiling or wall mounting. Special "open" design provides maximum of efficiency with a minimum amount of time and effort required for filter changes.

Mist and fog are collected in the immediate area of the work and disposed of in the filter chamber, preventing hazards to plant personnel and machinery.

For more data circle 71 on Postpaid Card

new shop equipment . . .



Famco Four Vane Rotary Type Air Grinder

LIGHTWEIGHT AIR GRINDERS

A lightweight, four vane, rotary type air grinder of 30,000 r.p.m. and 1/3 h.p. is announced by Field Abrasive Mfg. Co., Dayton, Ohio.

Available in both the straight and right angle types, they are guaranteed to give positive starting, and are claimed to give higher torque and h. p. output in a compact unit.

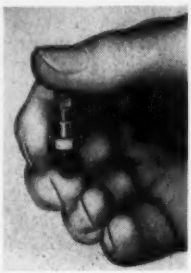
For more data circle 72 on Postpaid Card

★ modern machine shop ★

SILICON RECTIFIERS

A new, small silicon power rectifier, the Style 20, is available from Syntron Co., 309 Lexington Ave., Homer City, Pa. It is a fused alloy device, designed for operation at current levels from 1 to 15 amperes (single phase half wave average). Surge ratings are 90 amperes average at 6 cycle (0.1 second) and 50 amperes average at 60 cycle (1.0 second). Peak inverse voltages range from 50 to 400 volts in 50 volt steps. Temperature range is minus 65 to plus 175 degrees C.

For more data circle 73 on Postpaid Card



Silicon Rectifier

✱ Removing chips, shavings, filings, and airborne debris that clog machinery, distort tolerances, mar product finishes.

✱ Controlling mists and fogs in wet machining operations.

✱ Recovering valuable dusts, coolants, heated air.

✱ Protecting machinery investments with preventive maintenance.

FREE...latest specs and data on TORIT Dust Collectors for handling these and other air pollution problems. TORIT: the high efficiency line with savings up to 1/2!

✱ Reducing absenteeism with improved health and safety precautions.

WRITE TODAY:

TORIT MANUFACTURING CO.

1133 Rankin Street, St. Paul 16, Minn. Dept. 714■

For more data circle 447 on Postpaid Card

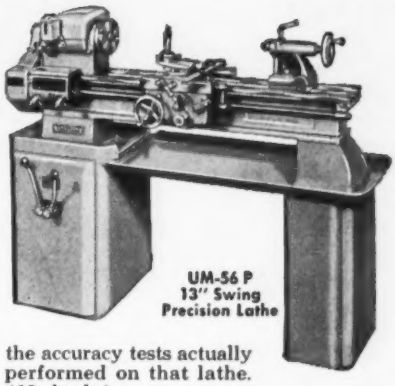
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

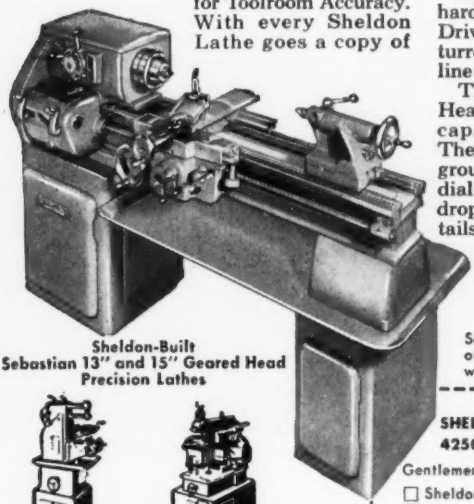
All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-56 P
13" Swing
Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

SHELDON
Horizontal Milling Machine

SHELDON
12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

4250 North Knox Ave., Chicago 41, Ill.

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON MACHINE CO., INC.
4250 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11" ☐ 13" Lathes
☐ Sebastian 13" and 15" Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call.

Name ..... Title .....

Company Name .....

Street Address ..... ☐ Company ☐ Home

City ..... State .....

For more data circle 448 on Postpaid Card

new shop equipment . . .

NEW DEVELOPMENT IN CHUCKS

The Skinner Chuck Co., New Britain, Conn., announces a new chuck development which is a principle utilizing combination of a pinon gear plate, screw and wedge. The result is a chuck which combines all the desirable features of hand and power chucks. The company claims that this new chuck has accuracy within 0.001 total indicator reading, repeatability without adjustment within 0.0005 total indicator reading, unequalled gripping power and no size limitations.

In operation, the pinion, which can be turned either by hand or by a power wrench, engages the gear plate, causing the screw to move the wedge. The action of the screw on the wedge controls the chuck jaws. The force of the wedge on the jaws holds the work with tremendous force.

Additional features are: overload protection, operator protection, higher chucking speeds, a center hole and sealed operating mechanism.

The chuck is available in the following sizes: 10, 12, 14, 15, 18, 21, 24, 28, 32, 36, 40, 50, 60 inches and above. It is also available in a choice of jaw types.

For more data circle 74 on Postpaid Card

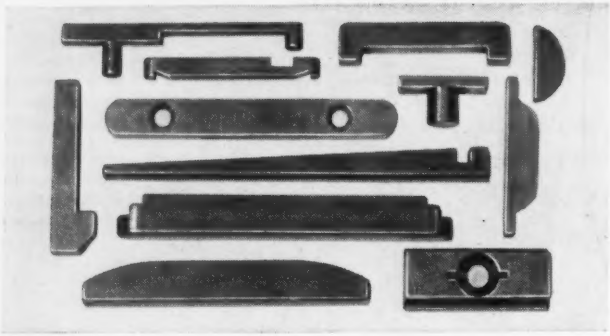
★ mms ★

GRINDING COOLANT

A soluble grinding coolant for grinding operations on carbon and tool steels, cast iron and titanium, as well as tool grinding where surface

Precision Made

GILLEN MACHINE KEYS AND PARTS



Keys to rigid tolerances

completely deburred. Gib Head and No Head Taper Keys, Straight and Round End Feather Keys. ready for use.

Parts in every shape and size

milled, drilled, tapped, countersunk, counterbored, heat-treated, surface ground in many metals.

Blueprints will receive prompt quotations
Ask for samples by size and type

JOHN GILLEN COMPANY

Keying and Pinning Devices

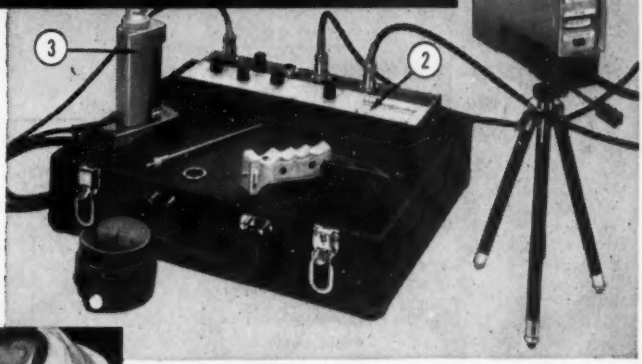
2564 South 50th Avenue • Cicero 50, Illinois

A subsidiary of Standard Railway Equipment Manufacturing Company

For more data circle 449 on Postpaid Card

All-New Precision Stewart-Warner
PORTABLE BALANCER

Engineered for precision balancing of all rotating machinery. 1. Stroboscope and meters mounted in same portable head for easy one-man operation. 2. Removable, lightweight electronic unit for easier balancing in confined spaces. 3. Electro-magnetic pickup can be placed on machine part, freeing operator's hands.



cuts maintenance costs by enabling you to eliminate even smallest vibrations!

Stewart-Warner's new portable balancer is priced to make it economical for even small shops to own their own balancing equipment. Its portability permits easy *in-place* balancing and vibration analysis of assembled machinery. Indicates angle and amount of unbalance . . . determines rpm and amount of vibration. Helps produce finer finishes and closer tolerances . . . aids in reducing noise and worker fatigue . . . permits quality control *before* equipment is put in operation or shipped to a customer.

Also: a complete line of permanently installed cradle type balancers to meet every job type or short run precision balancing requirement.

Mail coupon for full details!

Symbol of SW Excellence

STEWART-WARNER CORPORATION
Industrial Balancer Department
Dept. YY-109, 1850 Diversey Parkway
Chicago 14, Illinois

Please send me your Industrial Balancer catalogs.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

For more data circle 450 on Postpaid Card

finish is determined by the structure of the wheel has been developed by ShearSpeed Chemical Products Division, Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Michigan.

Prepared as a concentrate with permissible dilution ratios ranging up to 150/1, A-1000 coolant, it is claimed, provides exceptional economy with no loss in lubricity or solution stability; leaves no powdery deposit on the critical machine surfaces; and gives increased penetration at the contact between wheel and work through its low surface tension and excellent wetting qualities.

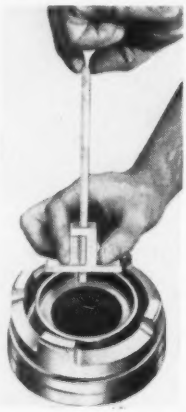
For more data circle 75 on Postpaid Card

★ modern machine shop ★

VERNIER DEPTH GAGE

Brown & Sharpe Mfg. Co., Providence 1, R. I., announces its Vernier Depth Gage No. 601 which offers design features that facilitate the use of this precision instrument. It has a dull chrome finish with jet black graduations, machine cut for accuracy, and a long vernier plate, 1.255 inches, which provides readings in 0.001 inch correspondingly easily.

Vernier graduations are flush



Vernier Depth Gage

GET THE FACTS

About Hardness Testing

Everything you need to know about hardness testing is told in this handsome book, prepared by the makers of the internationally respected CLARK Hardness Testers for "Rockwell Testing." Simple, easy-to-read text (in English) and numerous illustrations show the equipment and procedure for fast, accurate hardness testing of ferrous and non-ferrous materials. If you would like a copy, *free of charge*, just attach this ad to your letterhead or write "Send book." A copy will be mailed to you promptly.

P.S. If you are interested in descriptions and prices for CLARK Hardness Testers (Standard and Superficial) of *guaranteed accuracy*, say the word and we'll gladly supply them.

CLARK **CLARK INSTRUMENT INC.**

10204 Ford Road • Dearborn, Mich., U.S.A

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now available!

NEW VICTOR MOLY® HIGH SPEED HOLE SAWS

...cut clean, accurate holes in any machinable metal or plastic

Safe, shatterproof hole saws are now a part of the outstanding line of Victor metal cutting tools. Ruggedly built of the toughest high speed steels, these new Victor saws cut clean, accurate holes in any machinable metal or plastic. They can be used on a variety of power tools – lathes, drill presses, radial drills and portable power tools – to cut holes from 9/16" to 6" diameter, up to 1½" thick.

These fast cutting, durable hole saws – newest addition to the outstanding Victor line of power hack saw and band saw blades – are built to deliver better performance – and profit – in *your* operation. Why not prove it to yourself? Just drop us a note and we'll send full details promptly.

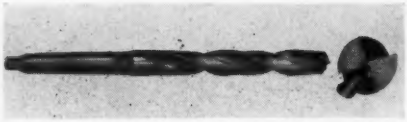
VICTOR

SAW WORKS, INC., Middletown, N. Y., U.S.A.
Warehouses in Chicago • Portland, Ore. • Houston
Makers of Hand & Power Hack Saw Blades, Frames, Metal & Wood Cutting Band Saw Blades

For more data circle 452 on Postpaid Card

with the blade graduations, eliminating parallax. Another improvement is the spring pressure clamp. It holds the blade firmly in position. A slight pressure releases the blade so that it slides freely to measuring position. It is available with 6, 12 and both 6 and 12 inch blades which provide readings over the full range of 6 and 12 inches.

For more data circle 76 on Postpaid Card



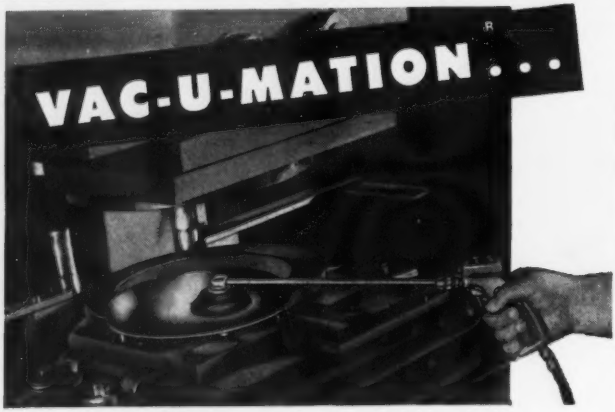
Speedicut Chipbreaker is shown above

CHIPBREAKER CUTS DRILLING COSTS AND INCREASES PRODUCTION

Speedicut Division, Chicago Heights Steel Co., Chicago Heights, Ill., announces a chipbreaker that features high feed rates and more holes drilled per regrind. With a web that is constant over the entire length of the flutes, deep hole penetration, up to 10 to 12 times drill diameter, is possible without withdrawal. Long spiral chips are eliminated by the chipbreaking rib, permitting coolant to flow freely to the point of the drill for maximum heat dissipation and non-clogging drill performance.

Designed for single or multiple spindle operations on all types of metals, the chipbreaker reduces down time and sharpening costs. Sizes range from ¼ to 4 inches.

For more data circle 77 on Postpaid Card

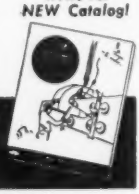


. . . offers you SAFETY and economy of feeding and ejection

PRES-VAC SAFETY FEEDERS feed blanks to press from a safe distance of 14 inches—BY AIR!—maximum protection to operators and handling costs kept at a minimum. Save those fingers. **$35.00**

AIR BLAST VALVES eject parts safely with each stroke of the press—BY AIR! Save those hands. **$29.00**

Write for NEW Catalog!



4583

LITTELL MACHINE CO.

VAC-U-MATION DIVISION

4143 Ravenswood Avenue, Chicago 13, Ill.

District Offices: Detroit and Cleveland

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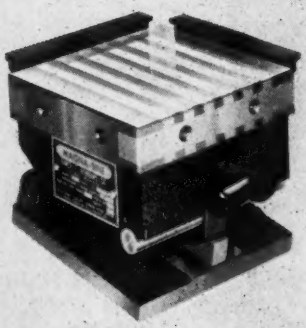
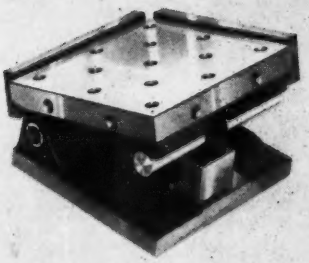
NEW
SMALL SIZE

LOWER COST,
FASTER ACCURATE ANGULAR
SET-UP OF SMALL WORK



Magna-Sine (Model B-3-MS)
With 4" x 4" Working Area



Sine Plate (Model B-3-SP)
With 4" x 4" Working Area

ROBBINS MAGNA-SINE

This new smaller Magna-Sine has all the time-saving, accurate angular set-up features found in larger Robbins Magna-Sines. Small to medium size work can now be set up in minutes instead of hours and with a lower investment in equipment. Magna-Sine table has a strong, fine pole, permanent magnet chuck that firmly holds small work without distortion.

ROBBINS SINE PLATE

Robbins small Sine Plate is manufactured to the same high standards of accuracy as the Magna-Sine. This precision makes it ideally suited for angular inspection set-ups. The ground surface of the non-magnetic table has tapped holes for convenient clamping of any work. Also, sturdy construction makes this small Sine Plate extremely suitable for light machining operations.

Compound angles are quickly and easily set up with this Robbins equipment by combining either two Magna-Sines, a Magna-Sine with a Sine Plate, or two Sine Plates. Now, with lower initial investment, every shop can secure accurate angular set-ups for small work. With Robbins equipment, you do a better job, faster and at less cost.

OMER E. Robbins COMPANY
11961 DIXIE AVENUE **DEPT. B** **DETROIT 39, MICH.**

For more data circle 454 on Postpaid Card

new shop equipment . . .

COLD FINISHED STEEL BARS

The "Century Series" of cold finished bars that offers steel parts producers a wide choice in the ratio of machinability to strength and toughness, is announced by Republic Steel Corp., 1441 Republic Bldg., Cleveland 1, Ohio. The bars, available in five grades, have a minimum yield strength of 100,000 p.s.i., with resultant higher hardness and wear resistance.

The cold finished bars — high strength, stress relieved—provide good mechanical properties, excellent machinability and dimensional stability. They are arranged on a sliding scale of sulphur content ranging from 0.24/0.33 down to 0.050 maximum. The grade choices available make it possible for a producer to pick the least expensive grade of steel which will comply with the mechanical requirements of the application and the degree of machinability that is desired.

For more data circle 78 on Postpaid Card

★ mms ★

LAYOUT FLUID WITH CAMEL HAIR BRUSH

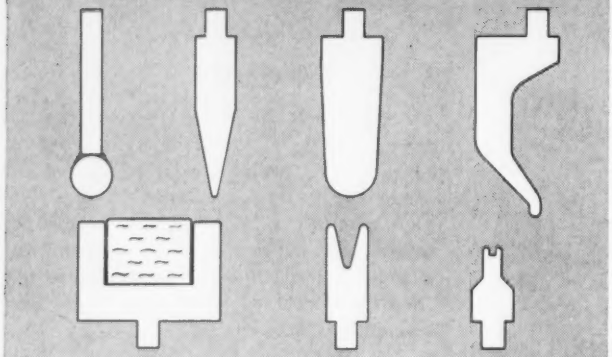
Dayton Rogers Mfg. Co., Minneapolis 7D, Minn., announces an all camel hair brush, furnished with its 4 ounce combination brush-in-cap container for layout fluid.

By the application of this camel

Layout fluid and camel hair brush

Alloy Forming for
AIRCRAFT
MISSILES
ROCKETS
and
OTHER FABRICATIONS

CHICAGO ALLOY-FORM DIES
For All Makes of Press Brakes



Here are a few of the commonly used types of CHICAGO Alloy-Form dies available for prompt delivery. For further data ask for Bulletin AFD-958. Complete recommendations and quotations on Alloy-Form dies or any special die upon request.

CHICAGO
DREIS & KRUMP
MANUFACTURING CO.
7418 S. Loomis Blvd., Chicago 36, Ill.

8741

Press Brakes • Press Brake Dies • Straight-Side-Type Presses
Hand and Power Bending Brakes • Special Metal-Forming Machines

For more data circle 455 on Postpaid Card

"there's something new in bearings, too!"

...ask your Bunting distributor

about startling new Bunting products in newly developed, low-cost bearing metals. Today he carries in stock for your money-saving convenience:

• **751** sizes of Sintered Oil-filled Bunting Bronze plain, flange and thrust bearings and 6½" tubular and solid bars. Only Bunting supplies sintered oil-filled stock bearings made to ASTM standards, assuring dependable uniformity and quality in every detail.

• **138** sizes of Bunting Bearing Aluminum 13" tubular and solid bars. Bunting Bearing Aluminum is the outstanding new low cost, light weight bearing metal that squarely meets many of today's urgent needs in machinery production and maintenance.

ASK OR WRITE FOR THESE CATALOGS:

CATALOG NO. 58—Listing 866 stock sizes of Bunting Cast Bronze Bearings and 13" tubular and solid Precision Cast Bronze Bars and 751 stock sizes of Bunting Bronze Sintered Oil-filled Bearings and Bars.

CATALOG NO. 258—Listing 343 Bunting Cast Bronze Electric Motor Bearings for all makes and sizes of electric motors from 1/50 to 100 HP.

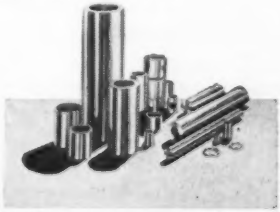
BAR CARD 40—Listing 138 sizes of Bunting Bearing Aluminum Tubular and Solid Bars and giving comprehensive technical data.

ENGINEERS—MANUFACTURERS
Write for "**ENGINEERING HANDBOOK ON POWDER METALLURGY**"—an authentic technical 48 page book by Bunting Engineers.

Bunting

BEARINGS, BUSHINGS AND SPECIAL PARTS OF CAST BRONZE OR SINTERED METALS. ALCOA® ALUMINUM BARS.

The Bunting Brass and Bronze Company, Toledo 1, Ohio
Branches in Principal Cities EVergreen 2-3451



For more data circle 456 on Postpaid Card

haired brush, the scribed layout lines are more pronounced, thus relieving eyestrain and allowing the workman to work accurately and easily to the desired layout.

It can be used on all sheet metals, and works to particular advantage on all non-ferrous material. It dries instantly.

For more data circle 79 on Postpaid Card

FOUR WAY BLEED OPERATED VALVE WITH BUILT-IN SPEED CONTROLS

A four way air control valve, part of a complete line, features speed of operation and self-contained speed controls, which allow easy adjustment of both the forward and reverse cylinder stroke, according to Cleveland Pneumatic Industries, 64 Old Orchard, Skokie, Illinois.

Operating on the bleed principle, only a minute volume of air must be released for the valve to shift.

The short stroke sleeve and valve insert are said to assure rapid response and flow change. It is said that this valve will operate on pressures as low as 1 pound per square inch. It can be operated from a remote source by connecting the bleed valve through tubing or pipe, to the point where actuation is desired.

For more data circle 80 on Postpaid Card

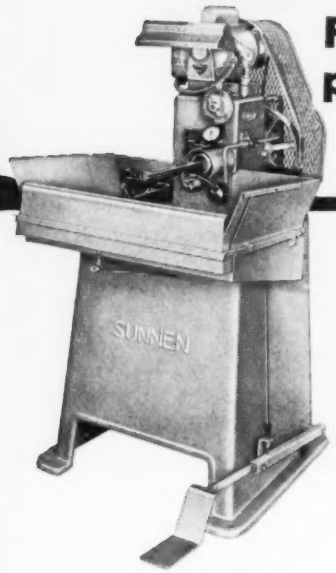
Air Control Valve

WAIT! Save Money!
DO THAT JOB FASTER AND BETTER WITH A Severance MIDGET MILL!
Ask for a SEVERANCE catalog today! YOU'LL FIND IT DETAILED, WELL ILLUSTRATED, SUGGESTIVE AND INFORMATIVE. IT INCLUDES LOW REGRINDING PRICES.
YES, A SEVERANCE MIDGET MILL MAY WELL SOLVE YOUR PROBLEM AND SAVE YOU MONEY, IF YOU MUST REMOVE GATES, FINS, AND RISERS; BREAK SHARP CORNERS AND EDGES; MACHINE CARBON; FINISH CASTINGS OF ANY MATERIAL; WORK FILLETS, RADII, AND GROOVES; DEBURR OIL HOLES; BLEND WELDED AND ASSEMBLED PARTS; REMOVE FLASH; SMOOTH WELD BEADS; OR ANY OTHER SIMILAR OPERATIONS
MANY STANDARD SHAPES & SIZES TO CHOOSE FROM
Severance MIDGET MILL SET NO. 77
SPECIAL SHAPES & SIZES AVAILABLE ON SHORT NOTICE
SEVERANCE MIDGET MILL SET NO 77 IS A POPULAR SET OF 1/2" DIAMETER, 1/4" SHANK, HIGH SPEED MIDGET MILLS. MAKES A FINE GET-ACQUAINTED-SET AND WILL COVER A BIG MAJORITY OF YOUR NEEDS FOR THIS TYPE TOOL. LEAFLET NO. 651 GIVES DETAILED INFORMATION AND PRICES.
ASK FOR IT TODAY!
Severance TOOL INDUSTRIES INC.
724 Iowa St. • Saginaw, Michigan
CARBIDE HAND FILES
REGRINDING
INSIDE DEBURRING CUTTERS
OUTSIDE DEBURRING CUTTERS
HAND DEBURRING CUTTERS
TUBE END DEBURRING CUTTERS
CHATTER-FREE ECONO-SINKS
SPECIAL CUTTERS
MICRO-MILLS & BORE-MILLS
BALL SEAT REAMERS

For more data circle 457 on Postpaid Card

THE SUNNEN HONING MACHINE

FAST STOCK REMOVAL plus precision on all four hole dimensions



1. **ROUNDNESS**—Produces geometrically-round holes; corrects any out-of-round pattern caused by chucking, heat treating or previous operations —with minimum stock in the workpiece.
2. **STRAIGHTNESS**—Levels all internal irregularities for end-to-end precision. Corrects taper, waviness, bow, hour glass, barrel, bell mouth, etc.
3. **DIAMETER**—Quick, economical precision sizing—with production tolerances down to .0001", or as close as .000025" if needed.
4. **SURFACE FINISH**—Produces consistent finish down to 2 micro-inches in hardened materials—no heat checks or smear metal.

Diameter range .120" to 2⅝". Hones open or blind holes, in almost any material from steel to glass. Average installation cost under $1,000. No jigs or fixtures, no chucking, no set-up time.

WRITE FOR FREE BULLETINS OR ENGINEERING SERVICE

WRITE FOR FREE BULLETIN

SUNNEN PORTABLE HONES

... size and finish holes anywhere in any position

The tools of a thousand uses. Invaluable for small lot production... for large or heavy parts... sizing or correcting undersized, tapered, or out-of-round bores in parts... for "on-the-job" hole re-sizing on machine repairs.

Requires no expensive set-up time; eliminates costly down time; maintains alignment. Fast stock removal, smooth surface finish, accuracy within .0005". Diameter range 1¾" to 20½". Powered by portable electric drill. (Can also be used in drill press or radial drill.)

SUNNEN® PRODUCTS COMPANY

FREE FIELD ENGINEERING ANYWHERE IN U. S. **HONING**

7924-J MANCHESTER AVE., ST. LOUIS 17, MO.
CANADIAN FACTORY: CHATHAM, ONTARIO

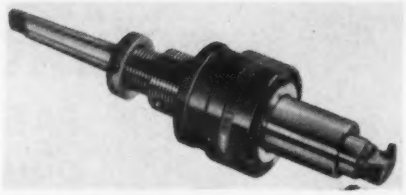
For more data circle 458 on Postpaid Card

8540R

new shop equipment . . .

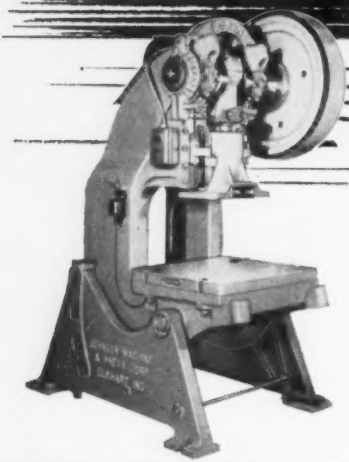
AUTOMATIC RECESSING TOOLS

A new line of automatic feed recessing tools, featuring interchangeable parts to increase work range, is announced by Scully-Jones and Co., 1909 South Rockwell St., Chicago 8, Ill. Designed for use on standard drill presses, radial drills and special machines, these tools can be used in performing intricate machining operations such as relieving, grooving, chamfering, backfacing, counterboring,



Scully-Jones Automatic Feed Recessing Tool

FOR HIGH SPEED NEEDS
on a low tonnage press



CHOOSE
JOHNSON!

MODEL 27W (27 TON)
MODEL 45W (45 TON)
MODEL 60W (60 TON)

These presses are especially adapted for handling large lightweight sheets and for notching or piercing off-center operations. *And at slower speeds they perform equally well for die cast trimming.*

Write for your copy of our complete 8 page catalog No. 59. Covers the complete line in easy-to-read chart form.

Special features of these models

• Extra Wide Beds • Extra Deep Throats • Extra Large Ram Faces • Extra Shut Heights • Extra Large Openings Through Backs • Pin Clutch or Air Clutch • Flywheel or Back Geared

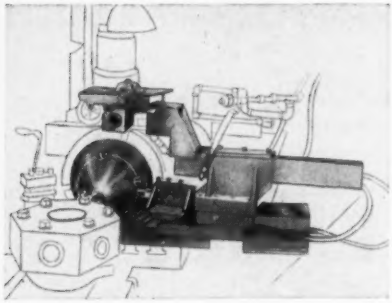
Johnson
POWER PRESSES
Johnson Machine & Press Corp.
Division Bontrager Corp.
620 West Indiana Ave., Elkhart, Indiana

For more data circle 459 on Postpaid Card

"a velvet touch and a tiger's response"

All MIMIK® Tracers—

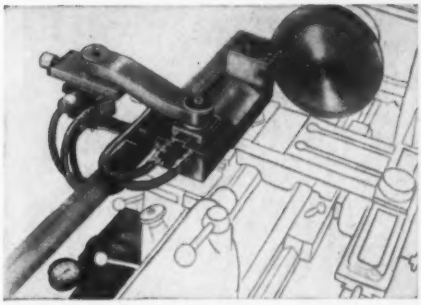
- Have universal positioning.
- Can fit any machine.
- Require only minutes to install.
- Involve no machine tool conversion.
- Are easy to set up.
- Can use templates or round masters.
- Fully guaranteed.
- Have unequalled accuracy.
- Have micrometer settings on X & Y.
- Interchangeable between machines.



MIMIK® can do all these things because its unique valve is so incredibly versatile there is practically no limit to the way it can be applied in a Tracing System.

Your MIMIK® Tracer will pay for itself in months, not years, and not only will slash costs, but will enable your existing machine tools to do work far beyond their present capacity.

THE RETOR® MIMIK HYDRAULIC TRACER



▲ **"9000" Series for Engine Lathes:**
- Six standard models to fit any lathe.
- Replaces existing compound.

"5000" Series for Turret Lathes:
- Rear mounted on ram type.
- Replaces 4-way tool post on saddle type.

"3000" Series for VTL's:
- No machine tool conversion.
- Fits into ram or turret like conventional toolholder or replaces tool post on side head.

▼

U.S. LICENSED MANUFACTURERS.

East Coast—Farmington Mfg. Co., Farmington, Conn.
Central—Bartsch Tool Corp., 6570 N. Harlem, Chicago.
West Coast—Allied Pacific Mfg. Co., 17825 S. Santa Fe Ave., Los Angeles.
Sales Representatives in all major U.S. and Canadian cities.

CANADA • RETOR DEVELOPMENTS • GALT, ONTARIO

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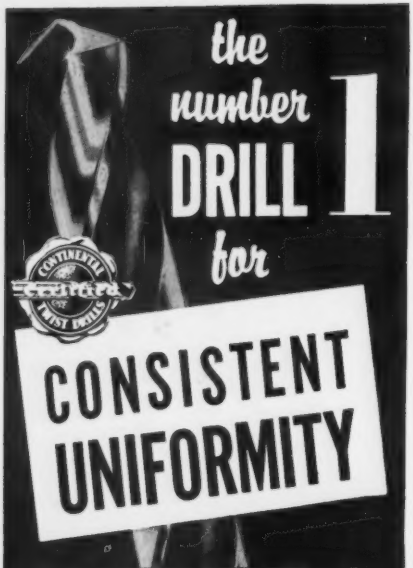

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DRILL CORPORATION
555 W. Adams St., Chicago 6, Illinois

WAREHOUSES:

NEW YORK	LOS ANGELES	TACOMA, WASH.
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FREE 4 PERMANENT TIME-SAVING CHARTS

6

Continental Drill Corp., 555 W. Adams Street
Chicago 6, Ill.

Send us FREE handy-form permanent charts checked below.

☐ Conversion Factors ☐ Drill Grinding Data
☐ Cutting Speeds and Feeds ☐ Tap Drill Sizes, Dec. Equiv.

Co. Name_____

Address_____

City_____ State_____

Attention:_____

For more data circle 461 on Postpaid Card

necking and boring. Two basic types and seven standard sizes cover work hole diameters from ¼ to 4½ inches and up to 0.300 inch depth of cut.

Four sizes of tools accommodate interchangeable stop collars and pilot-nose assemblies for piloting either in fixture bushings or in the work. Three sizes are provided for piloting only in the work and come with standard pilot-nose blanks.

Both types of tools are available with either eccentric or concentric tool mounting—eccentric for use with tool bits in small holes and concentric for use with circular form tools in large holes where maximum tool life is desired.

For more data circle 81 on Postpaid Card

★ modern machine shop ★

PRODUCTION PROFILING MACHINE

George Gorton Machine Co., 1706 Racine St., Racine, Wis., recently announced its "Auto-Trace" Electro-Hydraulic Series Profiling Machine with 360 degree automatic tracer.

"Auto-Trace" Electro-Hydraulic Profiler

BARNES ROCKET POWER BLADES

For Safe, Low-Cost, Accurate Sawing

The Barnes ROCKET Power Blade achieves a perfect combination of toughness and flexibility through "*Gradient Hardness*" to provide greater safety. Uniformly hardened teeth are temper-blended into a semi-hard back. The result is a one-piece blade with superior cutting ability.

Your Barnes Distributor maintains a complete stock of Barnes Hack and Band Saw Blades. He also offers you the services of an experienced Barnes Sales Engineer to quickly analyze your metal cutting requirements for maximum economy and sawing efficiency.

Call Your Barnes Distributor Today!

W. O. BARNES CO., INC.

1297 TERMINAL AVENUE • DETROIT 14, MICHIGAN

NOW 3 SIZES OF

E – M

DRILL UNITS

FOR YOUR

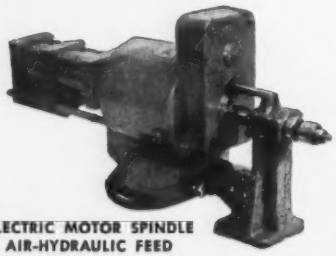
AUTOMATION

PROGRAM . . .

3/32" **CAPACITY — MODEL 111**
1,000 to 10,000 RPM or 2,500 to 15,000 RPM. Continuously variable speed control.

1/4" **CAPACITY — MODEL 113**
15 Speeds — 750 to 15,800 RPM.

1/2" **CAPACITY — MODEL 603**
600 to 4,000 RPM with Variable Sheaves.



ELECTRIC MOTOR SPINDLE
AIR-HYDRAULIC FEED

Write for literature and prices.

THE ELECTRO-MECHANO CO.
265 E. Erie St. Milwaukee 2, Wis.

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new shop equipment . . .

The automatic profiler operates in all lateral directions and can be furnished with automatic vertical increment feed. While the machine is in operation, it requires only occasional cutter inspection by the operator.

An outstanding feature is that electronic tracer control has been combined with hydraulic feeds.

Repetitive accuracy (one piece or a production run—part to master or part to part) to unusually close limits is possible on this machine. The human element of error is eliminated, once the setup is completed and the machine takes over.

For more data circle 82 on Postpaid Card

★ modern machine shop ★

METAL CUTTING BAND SAW

W. F. Wells and Sons, Three Rivers, Mich., has announced a horizontal metal cutting band saw specially developed for cutting a wide variety of materials in a project where large capacity is needed with restricted length of cut. Designated the X-60, the machine has a capacity of 60 x 60 inches and a maximum length of cut of 18 inches. The frame columns are large box sections with replaceable guide rail. The cutting head is raised by two hydraulic cylinders, one at each side of the frame. This feature

CAMS

Fully equipped modern machine shop with extensive Jig Boring, Surface Grinding, Horizontal Boring and Thread Grinding facilities as well as modern Cam Milling and Cam Grinding equipment.

Your Inquiries Answered Promptly

HIMOFF MACHINE CO., INC
23-16 44th Road Long Island City 1, N. Y.

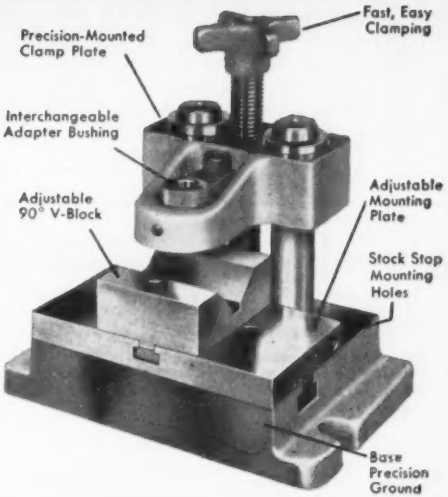
For more data circle 464 on Postpaid Card

REPCO *Time-Saving Tools*

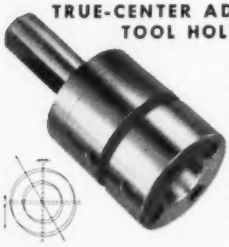
ADJUSTABLE V-BLOCK DRILL JIG

Saves Set-Up Time— Increases Output

Here is a versatile and accurate V-Block that makes center and off-center drilling, tapping, and reaming easy and precise. Four-way V-block adjustment simplifies handling a wide range of work. Fast, easy positioning and clamping speed production. A centering locator plug and T-slots in the mounting surface plates assure fast, easy, on-center adjustment. Drill capacity #80 to 5/16" diameter. Handles stock from 1/4" to 2" diameter.

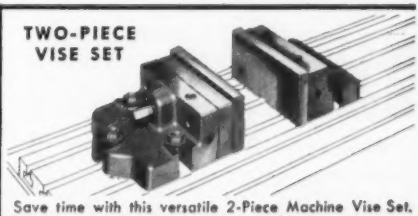


TRUE-CENTER ADJUSTABLE TOOL HOLDER



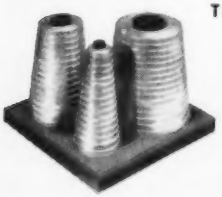
The REPCO Adjustable Holder is a precision-built tool, having two-piece construction which provides fast adjustment of the main body to compensate for as much as 1/32" machine misalignment. Cuts down on tool wear, breakage, and scrap.

TWO-PIECE VISE SET



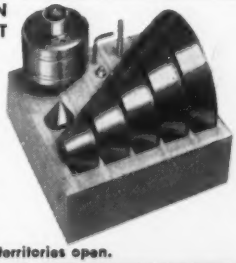
Save time with this versatile 2-Piece Machine Vise Set. Use as general-purpose vise, angle-block, or separate clamping device. Opening limited only to length of machine base. Light, accurate, rigid. Two sizes: 6" and 8".

CHUCK JAW TRUING-RING SET



This Ring Set saves time, cuts cost of boring jaws. With correct diameter rings at hand, you gain hours of productive time. Plated rings range from 1" to 4" by 1/8" increments. Handy peg-type rack keeps rings in place.

COMBINATION LIVE-CENTER SET



Heavy-duty live center plus six interchangeable adapters, ranging from a point to 6 1/4" dia. bell. Saves costly set-up and machining time necessary to make large-diameter centers. Straight and various taper shanks available.

Write for complete information—Exclusive agent territories open.

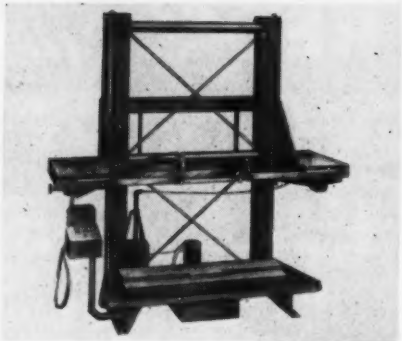
REPCO ROCKFORD ENGINEERED PRODUCTS CO.

23rd Ave. & 20th St., Rockford, Illinois

For more data circle 465 on Postpaid Card

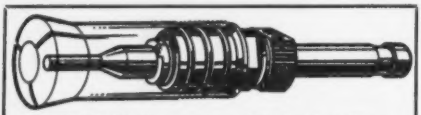
minimizes vibration and assures correct alignment, according to the manufacturer.

The cutting head rolls on a heavy guide rail with ball bearing rollers. Variable speed drive, infinitely adjustable from 60 to 300 feet per minute, provides the operator the exact speed for all materials. The operator dials the desired speed in complete safety while the machine is in operation. Panel-mounted controls have been located for the convenience of the operator.



Wells Model X-60 Metal Cutting Band Saw

For more data circle 83 on Postpaid Card



NEW! Self-Centering 5C Collet Stop

Quick friction adjustment. Stays in fixed position. Will not distort collet. Will not move back. Also available for other collets and spindles. 30 Days Free Trial. Several Territories Open for Distributors.

Write for Bulletin

BYCO INDUSTRIES

2200 Snelling Ave. Minneapolis 4, Minn.

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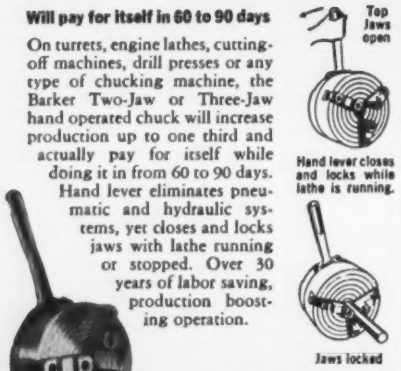
LABOR SAVING

Production CHUCK

Will pay for itself in 60 to 90 days

On turrets, engine lathes, cutting-off machines, drill presses or any type of chucking machine, the Barker Two-Jaw or Three-Jaw hand operated chuck will increase production up to one third and actually pay for itself while doing it in from 60 to 90 days. Hand lever eliminates pneumatic and hydraulic systems, yet closes and locks jaws with lathe running or stopped. Over 30 years of labor saving, production boosting operation.



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CHUCK DIVISION

THOMAS HOIST CO.

28 S. HOYNE • CHICAGO 12, ILL.

For more data circle 467 on Postpaid Card

SAVAGE

NIBBLING MACHINES

NIBBLE your COSTS

- No sparks
- No open flame
- No oxidation
- No secondary operations

No. 236

Totally enclosed head . . . . for safety.

Direct-over-center positive drive . . . gives more power.

One-piece 360° revolving head . . . . for fewer parts and longer life.

Write for folder

W. J. SAVAGE CO.

KNOXVILLE TENNESSEE

For more data circle 468 on Postpaid Card

MORE IMPRESSIONS PER DOLLAR WITH "GTS" TOOLS

GTS produces Marking Tools of uniform quality.

Your most rigid requirements will be met with every tool which bears the GTS trademark—whether your need is for one tool or for thousands.

The quality built into GTS tools results in longer life, more legible impressions —real economy.

From raw stock to final inspection, these tools are produced in our own plant by skilled craftsmen using the most modern facilities.

Hundreds of standard items can be shipped from stock. A complete inventory of alloy steels permits quick delivery on tools made to order.

Use GTS tools and *you'll know* that there is real economy in buying the best.

See us at Booth #1330.
CHICAGO METAL SHOW, NOV. 2-6
International Amphitheatre

IF IT'S WORTH MAKING, IT'S WORTH MARKING.

GEO. T. SCHMIDT, INC.
1806 West Belle Plaine Avenue
Chicago 13, Illinois

For more data circle 469 on Postpaid Card

300%...

MORE EFFICIENT

. . . Plus Greater Accuracy

Automatic machine shown also available as standard model.

Tests Prove Peerless Metal Cutting Band Saws are Over 300% More Efficient than Conventional Cut-Off Methods

Only Peerless has these big advantages:

- Counterbalanced saw frame
- Automatic feed pressure control
- Compensating feed unit which automatically regulates blade pressure
- Saws at 100% efficiency at all times

Write for free literature

PMC **PEERLESS MACHINE CO.**
RACINE, WISCONSIN

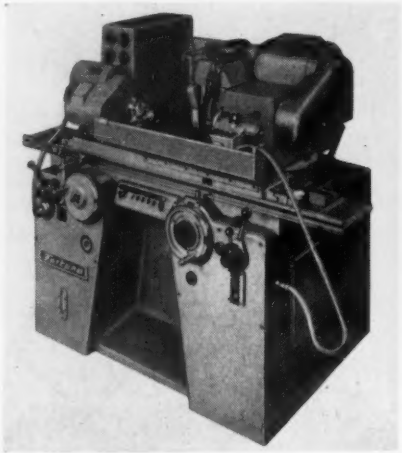
For more data circle 470 on Postpaid Card

CYLINDRICAL GRINDING MACHINES FOR PRECISION PRODUCTION

The Fortuna AFB Series Cylindrical Grinding Machines, 16 types from a plain manually fed grinder to fully automatic cycle control models, are available from Cosa Corp., 405 Lexington Ave., New York 17, New York.

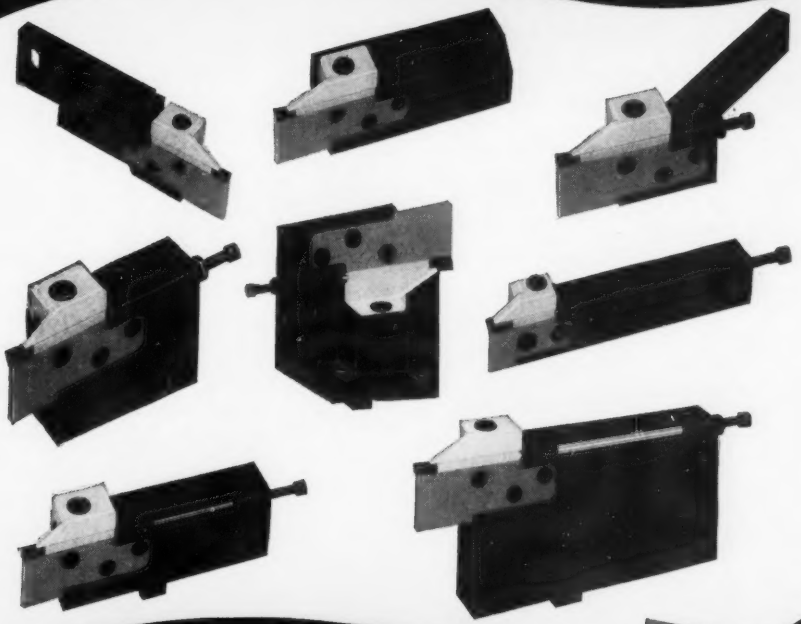
They are used for traverse and plunge-cut grinding and are easily adapted to internal grinding of single or mass produced workpieces. They feature a hydraulic table traverse with infinite speed variation between 2 inches and 26 f.p.m., two speed table traverse handwheel, easily adjusted table dwell and smooth, accurate table reversal to within 0.0004 inch. The workpiece holder table swivels for taper grinding, and has a dial gage and stop for angular settings. Built-in controls preselect traverse speed for grinding and wheel dressing.

For more data circle 84 on Postpaid Card



Fortuna AFB Series Cylindrical Grinder

NOW...A *Carbide* CUT-OFF TOOL for EVERY Application . . .



The complete line of P.D.Q. (Portage Double Quick) Manchester cut-off tools includes tooling for all makes of Turret Lathes, Engine Lathes, Production Lathes, Automatics and Cutting-Off Machines.

This wide selection of carbide tools, designed specifically for each type of machine, offers real speed and economy in parting and grooving problems. Write for the illustrated catalog covering all the available standard types. Specials available on request.

PORTAGE Double-Quick, Inc.

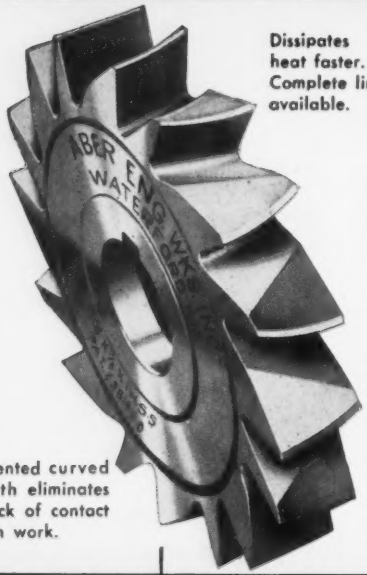
1041 SWEITZER AVENUE • AKRON 11, OHIO

Visit us at Booth No. 1845, National Metal Exposition.
For more data circle 471 on Postpaid Card

Shearing Action

LONGER RUNS *with*

ABER *Curved tooth* **CUTTERS**



Dissipates heat faster. Complete line available.

Patented curved tooth eliminates shock of contact with work.

ABER *Curved Tooth* **PLUS FEATURES**

- Give More Accurate Control of Limits and Finish
- Elimination of Chatter and Breakage
- Extended Cutter Life
- Better Performance
- Increased Production

FREE DATA — 24 page catalog on milling with ABER Cutters.

ABER ENGINEERING WORKS

WATERFORD, WISCONSIN

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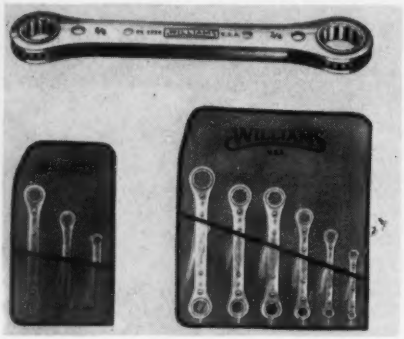
new shop equipment . . .



Williams Ratcheting Box Superrenches

RATCHETING BOX WRENCHES

Six sizes of ratcheting box Superrenches with 6 and 12 point openings from ¼ to ⅞ inch are announced by J. H. Williams & Co., 412 Vulcan St., Buffalo 7, N. Y. Nuts and bolts can be turned faster and easier with this new style of wrench. Openings are accurately broached to assure proper fit. All critical parts, made of selected alloy steel, are heat-treated for long lasting service and safety. Wrenches are chrome-plated over nickel.

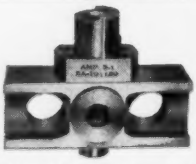
In addition to being sold individually, two sets are offered in plastic leatherette rolls.

For more data circle 85 on Postpaid Card

NEW

FLUSH PIN AMPLIFIER

OFFERS 5 to 1 AMPLIFICATION



- No dial indicator needed • No master required
- Extremely rugged • Speeds up inspection • .001 to .010 tolerance range. WRITE FOR DETAILS.

HOLMES GAGE & DEVELOPMENT CORP.

Columbus 3, Ohio

For more data circle 473 on Postpaid Card

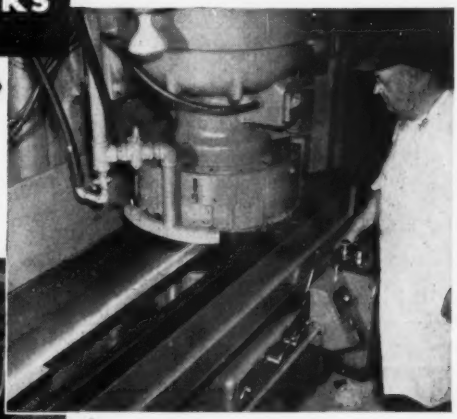
HOW TO CUT SET-UP TIME WITH Sundstrand Magnetic Chucks

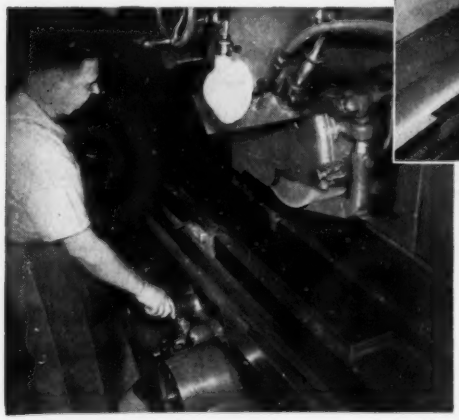
Here are two more examples of the profitable application of Sundstrand magnetic chucks to grinding operations. Similar, profitable applications have been made to milling jobs.

No matter how you are holding work pieces now, in grinding and milling, talk to a Sundstrand engineer. There is no obligation for this service.

SET-UP TIME CUT 30%

12"x96" transverse pole magnetic table on vertical spindle grinder holds various sizes of H.S.S. broaching tools at an average savings in set-up time of 30% over former method.





SET-UP TIME CUT 20%

Four 10"x40" POWER-GRIP Chucks on a 24"x96" horizontal spindle surface grinder hold ways, way caps, valve plates, broach holders etc. The four chucks can be operated individually or as one complete unit. Set-up time averages 20% less than previous method.

GET MORE FACTS

Write for further information on holding work for both grinding and milling operations.

BULLETIN 599-M

SUNDSTRAND

POWER-GRIP ®

SUNDSTRAND-AMERICAN BROACH

DIVISION OF SUNDSTRAND CORPORATION

MAGNETIC DEPT. ANN ARBOR, MICH.

For more data circle 474 on Postpaid Card

new shop equipment . . .

ACCESSORY FOR ROUGHNESS METER

An accessory to its roughness meter is announced by The Cleveland Instrument Co., 6220 East Schaaf Rd., Cleveland 31, Ohio. Directly interchangeable with its present line of surface roughness pickups, it extends the measurement range of internal diameters down to ⅛ inch. It will penetrate a ⅛ inch diameter hole to a depth of ½ inch and a ¼ inch hole to any desired depth. The pickup may also be used on flat surfaces and outside diameters as small as 0.030 inch.

The small size of the pickup makes it ideal for measurement of surface finish in slots, splines and gear teeth.

Accessory for Cleveland Roughness Meter

GRAYMILLS

Mist Coolant Systems

"The Best in Mist"

Precise air and fluid controls, corrosion proof. Translucent containers let you *see* the liquid level. Write for new folder.

GRAYMILLS CORP.
3769 N. Lincoln Ave.
CHICAGO 13, ILLINOIS

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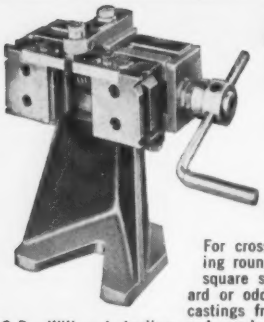
For more data circle 475 on Postpaid Card

SPEED UP DRILLING & TAPPING JOBS!



JOHN'S DRILL JIG

Self Centering

For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from ⅛" to 8" O.D. Will cut tooling and production costs to minimum for 10 to 100,000 pieces.
Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

Write for complete information

HEUSER MANUFACTURING CO.
1640 N. Paulina St. Chicago 22, Ill.

For more data circle 476 on Postpaid Card

MACHINE KEYS

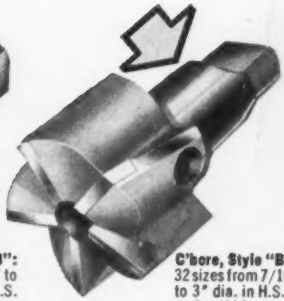
Our ability to furnish machine keys of every variety and from a wide range of materials is unsurpassed. Standard gib head keys, ⅛" taper in 12", are carried in stock in C-1018 Carbon Steel. In addition we can furnish plain taper keys, straight keys, round end feather keys, tit keys and many other varieties, upon request. All keys are made uniform to exacting tolerances. For your special needs we will gladly quote upon request. Send for new catalog giving complete information on Woodruff keys, taper pins, machine keys and gear rack.

STANDARD STEEL SPECIALTY CO.
BEAVER FALLS • PENNSYLVANIA
Plants: Beaver Falls, Pa.; Hammond, Ind.

For more data circle 477 on Postpaid Card

Core Drill: 25 sizes from 1½" to 3" dia. in H.S.S.

C'sink, Style "B": 6 sizes from ⅜" to 2" dia. in H.S.S.



C'bore, Style "B": 32 sizes from 7/16" to 3" dia. in H.S.S. and carbide.

stub taper drive makes a difference in tool cost

Scully-Jones counterbores, countersinks, and core drills with stub taper drive reduce tooling costs three ways. Replacement cost is lower because these tools have two parts—a cutter with stub shank and a driver. Only the cutter is replaced when worn out. The tough, hardened steel holder can be reused time after time.

They save indirect costs, too, because short, yet rigid and accurate, stub taper shanks are easy to insert and eject. They speed setup and tool change. When countersinking follows core drilling or counterboring, you simply switch cutters—in seconds—the holder stays in the machine.

Other savings come from elimination of cutter damage and scrap. The tang on the stub taper shank mates with a slot in the holder—provides a positive, slipproof drive.

For complete information on this unique tooling method, see your Scully-Jones distributor or representative, *or* phone: BIshop 7-5900.

Scully-Jones and Company

1909 South Rockwell Street, Chicago 8, Illinois

Styles 1 and 2 holder with 20° flutes to aid chip removal.

Style "B" holder for counterboring, countersinking and shallow core drilling.

SCULLY JONES CUTTING TOOLS

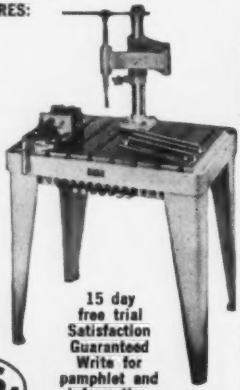
For more data circle 478 on Postpaid Card

Allman Universal Hand Tapper
5 TIMES FASTER

A great time, labor and material saver. Fixture taps five holes to every one using the free hand method. Eliminates costly tap breakage.

CHECK THESE FEATURES:

- Articulate arm swings clear of large table for placement of work.
- Limitless number of sizes of tapped holes without moving work piece.
- Vise holds work as small as ⅜" square.
- Floating tap locates itself in hole.
- Individual spindle holds taps, thus change requires only seconds.



15 day free trial
Satisfaction Guaranteed
Write for pamphlet and information

TOOLS, INC.
1734 No. 25th Ave. • Melrose Park, Ill.

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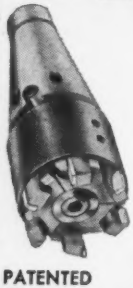
HOWALD CARBIDE MILLING CUTTERS



- SQUARE BLADES Easily Replaced.
- Simple, Accurate Blade Adjustment.
- Lowest Blade Cost.
- Cutters from 1½" to 14" dia.

PATENTED END MILL

PAT. SHELL MILL

SEND FOR BULLETIN

W. T. HOWALD MACHINE WORKS
182 SIGOURNEY ST., BROOKLYN 31, N. Y.

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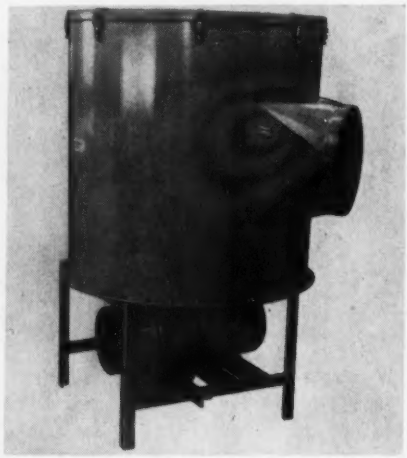
new shop equipment . . .



Hi-Speed Exhaust Shell for Aget Mistkops

EXHAUST SHELL FOR MIST COLLECTORS

A hi-speed exhaust shell, that fits all standard Mistkops, is announced by The Aget Mfg. Co., 1398 East Church St., Adrian, Michigan.

The shell, which speeds up filter change, is made of heavy gauge steel, enameled in grey tone. The shell top is equipped with quick action clamps for fast removal. With the top off, the old filter can be removed and a new one inserted in a few minutes.

For more data circle 87 on Postpaid Card

THE SCHWIETERMAN CENTER FINDER

Inside and outside diameters are located with machine spindle running, duplicating exact machining conditions. For jig borers, vertical & horizontal mills, lathes, drill presses, etc. From.... $2.00

PRECISION GAGE & TOOL COMPANY
320 E. Third St., Dayton 2, Ohio, USA

For more data circle 481 on Postpaid Card

How Allison Wheels help you get

Quick, accurate cuts on almost any material or shape

• Abrasive cutting can give you *cleaner* cuts, *faster*—on almost any material from titanium to fire brick. But only with the proper cut-off wheel can you get best results. That's where your ALLISON-CAMPBELL Field Engineer can help. He can select the ALLISON wheel to cut metals and other hard materials at speeds of just a few seconds per square inch—fine finish, no burn, with little or no burr—accuracy within close tolerances. There's an ALLISON wheel for every abrasive cutting job.

Resinoid bonded wheels • for dry abrasive cutting at speeds of 3 to 5 seconds per sq. in. **Rubber bonded wheels** • for wet cutting of all types of steel, alloys, titanium, glass, plastics. **Masonry cutting blades, including reinforced types** • for wet and dry cutting of fire brick, concrete block, tile, other building materials. **Fiberglass reinforced wheels** • for extra strength on many foundry jobs.

GET THE COMPLETE STORY! • Write for **Bulletin DH-214** for detailed information on abrasive cutting and wide selection of ALLISON wheel specifications. ALLISON wheels available 3″ to 34″ diameter, .006″ to 3/16″ thick. And remember—your ALLISON-CAMPBELL Field Engineer can give you specialized help. Specify ALLISON wheels for efficient, accurate, economical cutting.

ACCO

ALLISON ABRASIVE CUTTING WHEELS

Allison-Campbell Division • American Chain & Cable Company, Inc.
931 Connecticut Avenue, Bridgeport 2, Conn.

For more data circle 482 on Postpaid Card

new shop equipment . . .

WHEEL DRESSER

Last Word Sales Co., 18500 Mt. Elliott Ave., Detroit 34, Mich., announces the Dymond Cut Wheel Dresser.

This versatile little wheel dresser gives substantial wheel life savings and increases life and performance of cutting tools.

This Dymond Cut Dresser is shown dressing and truing a pedestal grinding wheel

It is especially suitable for dressing and truing plate mounted and pedestal type grinding wheels. Bearing life is claimed to be increased by the proper dressing of the wheel, giving a true balance, which is also a safety feature.

The dresser is equipped with an approximate ¼ carat diamond which is replaceable.

For more data circle 88 on Postpaid Card

Guide Pins and Bushings

Hardened and ground. Standard and special machined parts.

Write for folder!

Bard Mfg. Co.

ROYERSFORD • PA.

For more data circle 483 on Postpaid Card

KUTMORE

ADJUSTABLE HOLLOW MILLS

- ANY COMBINATION of . . . Turning . . . Tapering . . . Facing . . . Chamfering . . . Trepanning in ONE PASS.
- Exclusive MICROMETER Adjustment Feature For Rapid Set-Up.
- Cutting Capacities From 1/32" to 2" Diameter in Standard Stock Immediate Delivery.

WRITE FOR CATALOG 20-MM

PRECISION STARTS HERE:

CARL WIRTH & SON, INC.

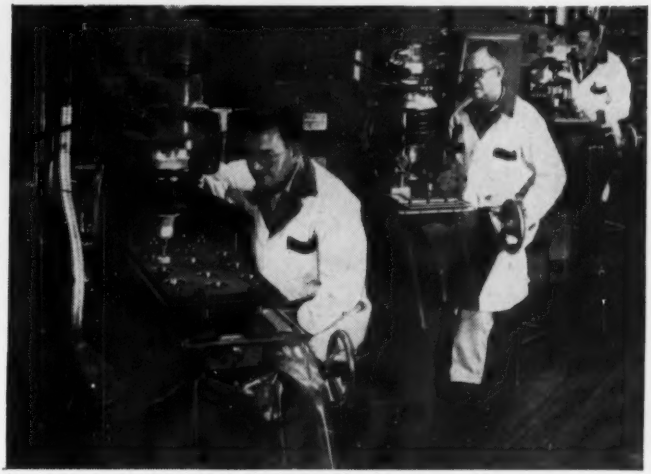
1625 CLINTON AVE. NO. ROCHESTER 5 N.Y.

For more data circle 484 on Postpaid Card

Val Koller tells why he continually adds more Moore Jig Borers and Jig Grinders to his team

This is another in a series featuring the views of owners of leading tool and die companies.

by **VAL KOLLER**
President
Koller Die & Tool Co.,
Milwaukee, Wisconsin
Manufacturer of Dies
and Metal Stampings—
Tools—Jigs—
Fixtures and Gages—
Special Machines



Moore equipment in Koller plant, with new #3 Jig Grinder in foreground.

"Since our foundation in 1919 it has been my personal objective to strive for perfection. Since that time perfection has evolved into a .000010" word for tool and die makers. Such precision is rapidly becoming common-place... particularly in electronics and guided missile fields of production. With the installation of Moore equipment in 1950, we have been able to compete successfully in a caliber of work that before was not possible.

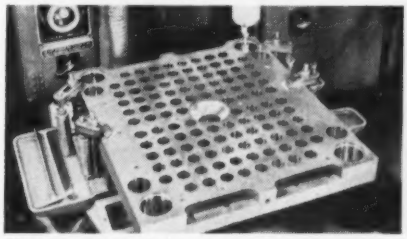
"Since that initial investment in a Moore Jig Grinder we have continually added Moore teammates to our toolroom. Today we operate more Moore equipment than any other top contract shop in the greater Milwaukee area.

"The tolerances and intricate contours now required make Moore Jig Borers and Jig Grinders a must in each toolroom. These machines operate at full capacity each workday with negative downtime due to mechanical failures. In fact, we have found that it costs real dollars and cents to operate *without* Moore equipment.

"This cost factor is just one of many reasons why we recently added another teammate to our toolroom ...the new Moore Model #3 Jig Grinder. This machine, with its tenth-splitting accuracy, hardened ways and wider range, enables us to service more customers better."

Write today for literature describing the unique features of #3 Moore Jig Borers and Jig Grinders or see our catalog in SWEET'S MACHINE TOOL FILE.

MOORE SPECIAL TOOL COMPANY, INC.
730 Union Avenue, Bridgeport, Connecticut



This 116 cavity mold plate was completely jig ground at Koller on a Moore Jig Grinder. Tolerances: hole location ± .0001", hole diameter ± .0001".

HOLES, CONTOURS AND SURFACES, tells how to produce tools and dies *the modern way*. 424 pages, 495 illustrations. $5 in U.S.A. $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

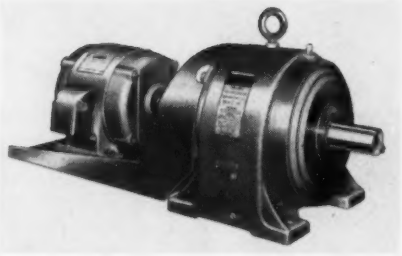
JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES HOLE LOCATION ACCESSORIES

For more data circle 485 on Postpaid Card

new shop equipment . . .

GEAR REDUCERS

A line of standard gear reducers, with mounting facilities to accommodate separate, coupling-connected Lima standard NEMA motors of suitable horsepower, speed and electrical characteristics, is announced by Lima Electric Motor Co., Inc., Dept. 144, Lima, Ohio. These gear reducers are available for horizontal foot mounted applications, in either double or triple reduction units; double reduction units have a horsepower range of 1 through 125 h.p., with reductions from 230 to 45 r.p.m. Triple reduction units range from 1 to 50 h.p., with reductions from 37 to 7½ r.p.m.



Lima Standard Horizontal Gear Reducer

For more data circle 89 on Postpaid Card

CAMS

MADE TO YOUR SPECIFICATIONS

—Except Screw Machine Cams—

Design Assistance Offered

KIDDE PRECISION TOOL CORP.

15 LOCUST AVENUE ROSELAND, N. J.

For more data circle 486 on Postpaid Card

DRILL HARDENED STEELS WITHOUT ANNEALING —

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon - high chrome steels of any degree of hardness. "HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly. *Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" Drills are cutting costs in thousands of plants.*

BLACK DRILL COMPANY, INC.

1372 East 222nd Street • Cleveland 17, Ohio

YOU HARDEN IT — WE'LL DRILL IT WITH — **"HARDSTEEL"**

For more data circle 487 on Postpaid Card

MUCH MORE - for LESS!

with *Cleveland* ROUGHNESS METER

The Roughness Meter was designed to do more than any other surface measurement instrument at a price within the range of any budget.

More VERSATILE—with less equipment you can measure the widest range of surface shapes—outside diameters down to .030"—inside diameters as low as .25".

More ACCURATE—less arguments. Precision calibration and construction exceeds all military and industrial standards.

More VALUE—lower cost. You will save from 35% to 100% over the cost of comparable equipment.

More CONVENIENCE—less confusion. The easiest to operate. Clearly marked controls, skids, adjustable tolerance hands.

other CLEVELAND PRECISION INSTRUMENTS

INDI-AC—Ultra-Precision Electronic Height Gage

•

MICRO-AC—Electronic Micro-Comparator

•

PAR-AC—Electronic Production Gage

•

INDI-RON—Ultra-Precision Roundness, Squareness and Concentricity Gage

•

INDI-AC Jr.—General purpose precision gage. Battery and AC operated.

•

AU-MAC—Automatic Machine Control and Positioning Systems

Cleveland **INSTRUMENT COMPANY**

6220 East Schaaf Road • Cleveland 31, Ohio

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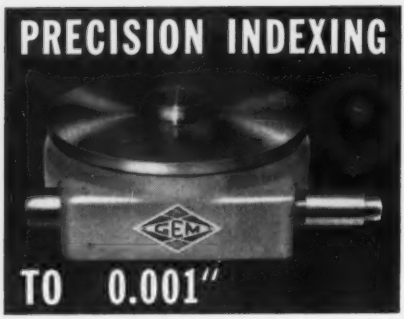


with GEM-17 DIAL INDEX TABLE

True geneva motion gives positive lock, speeds to ½ sec. Rugged 1000 lb. fixture load capacity with solid anvil capacity of 30 tons. Standard 17" dia. (plates to 36" available). Gray's engineering staff will adapt tables to your work problems.

Send for Bulletin DI-17 and full information.

gem **GRAY EQUIPMENT CO.**
13600 FORD ROAD
DEARBORN, MICHIGAN

For more data circle 489 on Postpaid Card

Grind Metal Saws
in Gangs, Automatically

Wardwell's 57T will make money for you. Sharpens as many as 250 Milling Cutters, Slitting and Screw Slitting Saws at one time. Automatic indexing.

Write for Bulletin 57T

WARDWELL
3803 Ridge Rd. • Cleveland 9, O.

For more data circle 490 on Postpaid Card

new shop equipment . . .

Wallace Tubela All Steel Bending Unit

BENDER

Wallace Supplies Mfg. Co., 1804 West Cornelia Ave., Chicago 13, Ill., announces the Tubela Bender which is a precision built unit of great ruggedness—all steel. The ram develops eight tons of pressure through the manual hydraulic pump.

The bending dies are all finished to a close fit on the pipe for extra quality bends. Rapid power return stroke withdraws the work from the tight fitting dies.

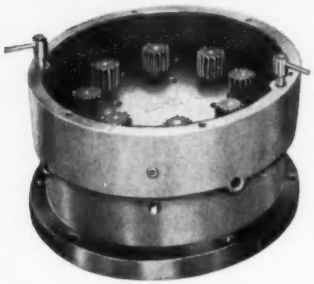
The machine and six sets of bending dies: ½, ¾, 1, 1¼, 1½ and 2 inches (to iron pipe standards) plus a straightening shoe come packed in a strong metal case. Other ram benders to 18 inches in diameter are available.

For more data circle 90 on Postpaid Card

DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Pa.

For more data circle 491 on Postpaid Card

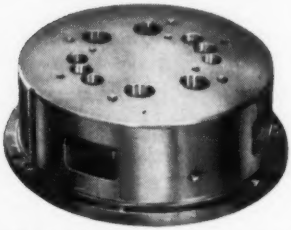
WISCONSIN multiple-spindle *Convertible* type head for drilling, tapping, spot facing, counterboring



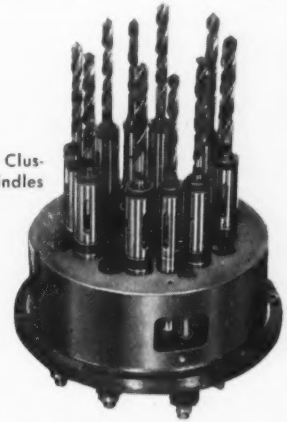
Master Drive Head with Pick-off Gears.

If you have found that *convertible type heads* fit into your production program most effectively, you will want to profit by the experience of the WISCONSIN engineering staff in designing and building heads of this type.

WISCONSIN designs and builds all of the popular and widely used types of drill heads: Standard Multiple-Spindle Adjustable drilling and tapping heads; Fixed Spindle drilling and tapping heads; Rotating Heads; Bracket-Type Universal Joint Drill Heads and special machinery.



Cluster Box Housing showing Hole Pattern. Can be furnished with round, square or rectangular positioning.



Multiple-Splindle Cluster Plate with Spindles and Idler Gears.

Slip-Type Spindle with Idler Gears used in all convertible-type heads.

CONSULT OUR FIELD ENGINEERS OR WRITE —

WISCONSIN DRILL HEAD CO.

4983 NORTH 124TH STREET • BUTLER, WISCONSIN

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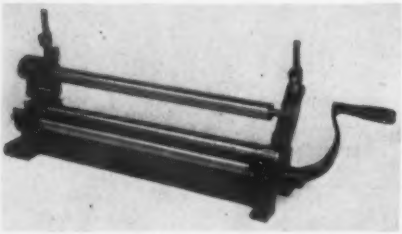
new shop equipment . . .



Berkroy 24 Inch Slip Roll is shown above

24 INCH SLIP ROLL

Berkroy Products Co., 1171 East 32nd St., Los Angeles 11, Calif., announces a slip roll that will accurately roll 24 inch widths in 20 gauge mild steel and heavier gauges in narrower widths.

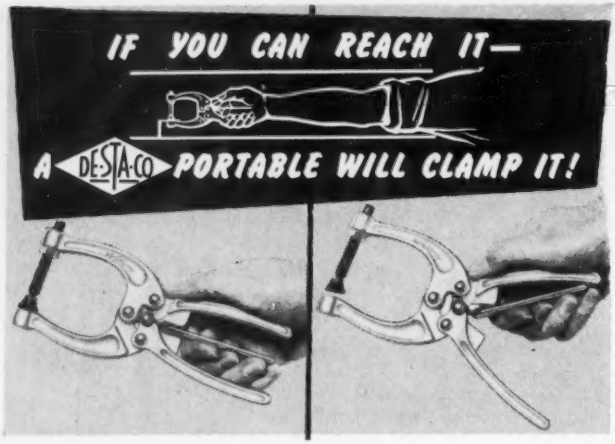
Fingertip controls, in conjunction with cam lock design on the top of both sides of the slip roll, permit fast and accurate adjustment for any material thickness within the capacity range of the slip roll.

Removal of the work is claimed to be easy, due to the spring loaded hinged top roll. Once the slip roll is adjusted and locked for a particular job, repeated production of identically rolled pieces is possible.

The base of the unit is made of channel iron. This construction prevents distortion of the unit when bolted to a bench or under the stress of heavy rolling operations.

Cast iron gears are fully enclosed for extra safety. Oilite bearings, which eliminate need for lubrication during the entire life of the unit, are standard equipment.

For more data circle 91 on Postpaid Card



Thousands of awkward clamping problems have been solved by the use of De-Sta-Co Portable Clamps. The new 2-way trigger release on Model 462 above illustrates easy one-hand releasing by pressing trigger toward either handle, essential in many blind or awkward operations. You now have a selection of two dozen basic portable models, including such features as . . .

★ *Two-way Trigger Releases* ★ *Flexi-matic and Pressure-matic spindles*
★ *Deep jaws* ★ *Non-magnetic materials for special applications*
★ *Light weight models* ★ *Special adaptations for your job*

De-Sta-Co Portables offer openings ½" to 6", throat depths to 3½", pressures from 35 lb. to 1200 lb. Send for catalog covering over 130 types, sizes and models of portables and fixture clamps—and name of stocking distributor.

Also De-Sta-Co stampings, washers, spacers, shims, shim stock, feeler stock, blower housings, marine specialties.

DE-STA-CO **DETROIT STAMPING CO.**
349 MIDLAND AVENUE • DETROIT 3, MICHIGAN

For more data circle 493 on Postpaid Card

NEW IMPROVED HARD FACING

Tough, hard ceramic coatings provide superior bearing surfaces

Sprayed alumina forms "sapphire-hard" surfaces highly resistant to wear, abrasion and corrosion. Ideal for bearing surfaces, seals.

Development of the new METCO THERMOSPRAY GUN for spraying high-melting-point ceramic materials at low cost opens up a variety of new practical applications. One that has produced a great deal of interest is the use of sprayed alumina coatings for bearing surfaces and mechanical seals. This THERMOSPRAY 101 Ceramic Powder produces surfaces with a hardness of 9.0 on the Moh scale, (only the diamond rates 10.0) with excellent resistance to wear, abrasion and corrosion. When used in combination with special phenolic or furane plastic sealers it provides superior protection against many acids.

Another THERMOSPRAY Powder – 201 – is zirconia which is somewhat softer than No. 101 but provides superior heat-insulating properties. Melting point of this material is 4600° F. and particle hardness 8.0 on the Moh scale.

Hard-facing alloys of the self-fluxing, nickel-boron-silicon type in powder form can also be applied with the METCO Type P THERMOSPRAY GUN. These coatings may be fused, semi-fused, or left unfused depending on the hardness desired, from RC 30 to RC 65, depending on the alloy and the process used.

The new THERMOSPRAY GUN operates without compressed air, only oxygen and acetylene being required. The free-flowing THERMOSPRAY powders are fed to the flame nozzle from a hopper atop the gun, melted and propelled to the surface to be coated. These materials are sprayed many times faster (up to 15 sq. ft. per hour—.010" thick) than has been possible with equipment previously available. Deposit efficiencies are in excess of 95%. These factors result in extremely low coating costs.

Preliminary engineering data contained in Bulletin 127 covers ceramic coatings while Bulletin 126 covers the hard-facing alloys. Either or both may be obtained by filling out the coupon below or writing on your company's letterhead. No obligation, of course.

The following trade names are the property of Metallizing Engineering Co., Inc. METCO®, THERMOSPRAY. *®Reg. U.S. Pat. Off.*

Pump rod sprayed with alumina provides superior protection against abrasion and corrosion

METCO®

Metallizing Engineering Co., Inc.

1177 Prospect Ave.
Westbury, L. I., New York

Please send me ☐ free Bulletin 127 (ceramic coatings)
☐ free Bulletin 126 (hard-facing).

Name _____

Title _____ Company _____

Address _____

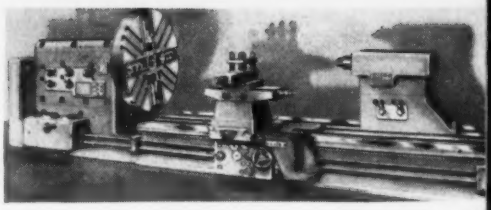
City _____ Zone _____ State _____

For more data circle 494 on Postpaid Card

new shop equipment . . .

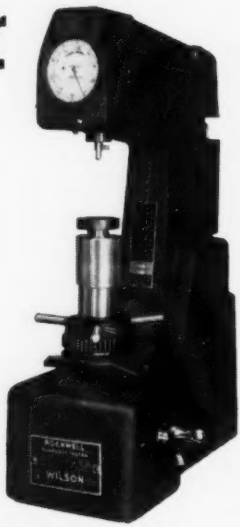
LARGE SWING MISSILE LATHE

Aaron Machinery Co., Inc., Dept. M, 45 Crosby St., New York 12, N. Y., has added two additional models to its line of missile lathes. They are specially designed for rapid and accurate turning of lightweight large diameter pieces, such as missile com-



The Aaron Large Swing Missile Lathe

One of these Wilson "Rockwell" instruments will do your hardness testing job



No matter what your hardness testing requirements are, there's a Wilson "Rockwell" tester to do the job. Choose from this complete selection of hardness testing equipment:

"Rockwell" Hardness Tester—for most hardness testing functions.

"Rockwell" Superficial Tester—for extremely shallow indentations.

TwinTester—Combines functions of "Rockwell" and "Rockwell" Superficial testers.

Semi and Fully Automatic—for high-speed testing, at rates up to 1,000 pieces per hour. Automatically classifies pieces as CORRECT, TOO HARD, or TOO SOFT.

Special Machines—for testing large objects, internal readings, and other unusual applications.

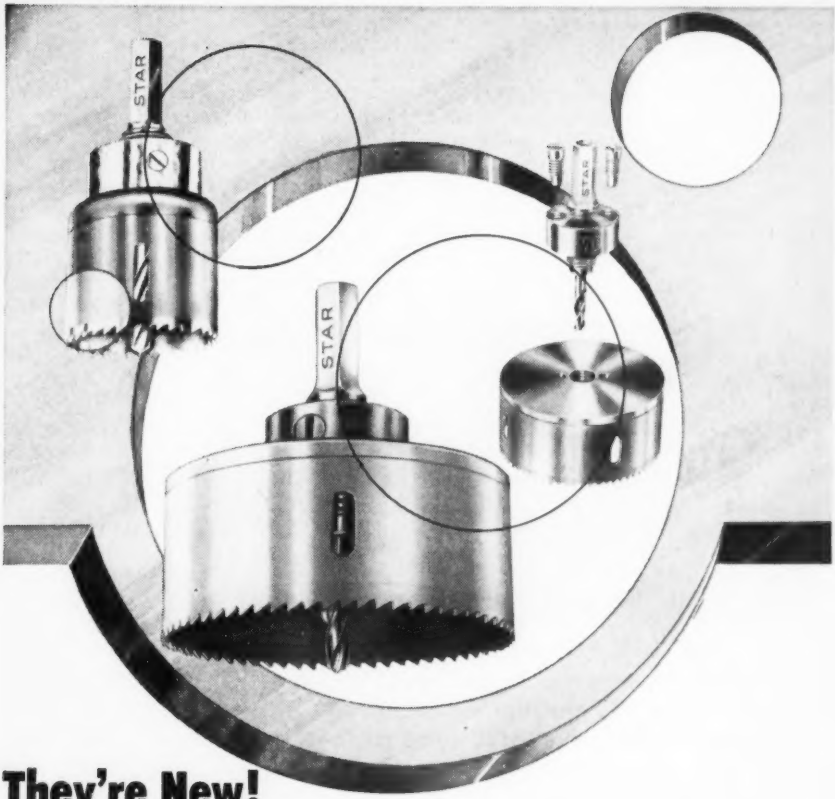
Diamond "Brale" Penetrators—Flawless diamonds, individually calibrated, and highest quality construction assure perfect testing every time.

Write for Bulletin RT-58

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-G Park Avenue, New York 17, New York
For more data circle 495 on Postpaid Card



They're New!

STAR Moly® High Speed Hole Saws

. . . the fastest cutting, most durable hole saws ever—latest addition to the outstanding STAR line

TRADE MARK

Completely safe, shatterproof line of hole saws. They feature extra-tough bodies—high speed steel cutting edges—cut clean round holes from 9/16" to 6" diameter, in metals, plastics, wood—up to 1-1/2" thick. New STAR Moly® High Speed Hole Saws—suited for use with portable power tools or machine tools such as lathes, drill presses, radial drills.

Because STAR Hole Saws are the fastest cutting, most durable hole saws you've ever tried, you can be sure that they'll deliver better performance—and profits—for you. If *you'd* like to hitch your wagon to fast cutting STAR, write soon. We'll send full details promptly.

2074

Write today for full details.

STAR HACK SAW and BAND BLADES

Manufactured by **CLEMSON BROS., Inc.**

Middletown, N. Y., U. S. A.

Warehouses in Brooklyn • Chicago • Denver • Houston • Los Angeles • Newark • New York City • Portland, Ore.

Makers of Hand and Power Hack Saw Blades, Frames, Metal and Wood Cutting Band Saw Blades and Clemson Lawn Machines

For more data circle 496 on Postpaid Card

ponents, heat exchanger and other large cylindrical and tubular shapes and cones, and have a swing of 94½ inches over carriage and bed.

Two separate beds are provided, both independent of the headstock unit. The widest carries the hydraulically operated apron, compound and cross slide and the second bed bears the tailstock and rests. This permits full travel of the carriage along the full length of the bed, regardless of the position of the tailstock and rests.

The headstock unit houses the 28 h.p., a.c. driving motor inside a massive cabinet, protecting it from dirt and chips, yet fully accessible for servicing.

Eighteen spindle speeds are provided from 0.6 to 160 r.p.m. Six of the 18 speeds are through an internal gear face plate drive so that all requirements, for either large or small diameter work, both rough and finishing cuts at proper speeds, are provided.

For more data circle 92 on Postpaid Card

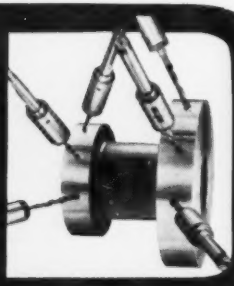
★ mms ★

SWIVEL BASE FOR DIVIDING HEADS

A newly developed swivel base is available from L-W Chuck Co., 28 South St. Clair St., Toledo 4, Ohio, for all models of the complete line of

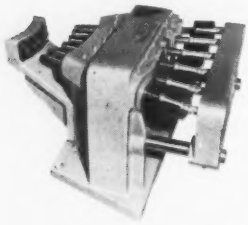
Swivel Base for L-W Dividing Heads

Can you drill this
PERIPHERAL HOLE PATTERN
at a profit?



U.S. Drill Head engineers can show you the cost-reducing way to do these tough jobs—just as they did for a missile manufacturer, producers of automotive parts, diesel engines, and in many other industries.

New products of the space age continually bring new manufacturing problems. Take advantage of U.S. Drill Head Co.'s leadership in applying multiple drilling and tapping heads to your drilling operations.



U.S. Fan-Shaped Heads for peripheral drilling—full ball bearing shaft mounting, shaved gears, super-finish spindles, full torque, maintained precision.

US DRILL HEAD
Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.
UNITED STATES DRILL HEAD CO.
BURNS STREET • CINCINNATI 4, OHIO

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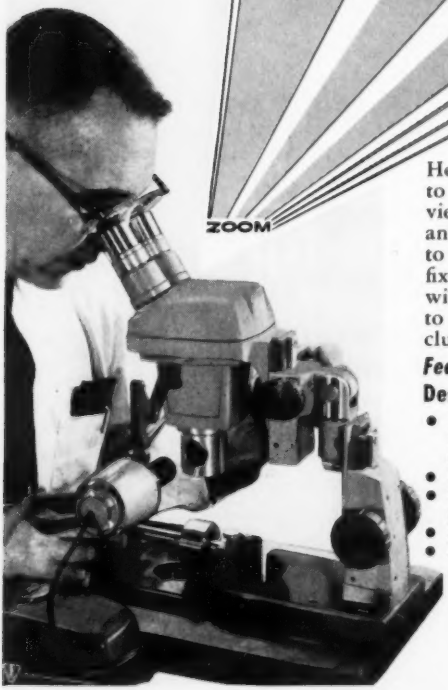
Only NEW BAUSCH & LOMB STEREOMICROSCOPES *give you*

STEREO ZOOM



ZOOM

CONTINUOUSLY VARIABLE POWER

Here's a completely new optical concept to speed and simplify work requiring 3D views. Just turn the magnification knob and watch the brilliant stereo image zoom to the *exact* size you need. Not just a few fixed powers, but *any* power within the wide stereo range. The newest step forward to faster, easier 3D work . . . and it's exclusive with Bausch & Lomb.

***Featuring Exclusive* POWER POD Design Concept**

- Sealed to prevent dust and foreign matter from entering optical system!
- No nosepiece!
- No individual objectives . . . no objectives to change!
- No image jump!
- No image blackout!

***Featuring* NEW LOW PRICE**

. . . about one-third lower than previous line!

FREE! Mail coupon for 24-page book of actual case histories: how 3D Microscopes speed production.

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America's only complete optical source . . . from glass to finished product

BAUSCH & LOMB OPTICAL CO.
89346 St. Paul Street, Rochester 2, N. Y.

- ☐ Send me new B&L Stereomicroscope Catalog D-15.
- ☐ Schedule a demonstration at my convenience.
- ☐ Send case history booklet D-1089.

Name, Title .....
Company .....
Address .....
City ..... Zone .... State .....

For more data circle 498 on Postpaid Card

L-W dividing heads, making them fully universal. Rising blocks also have been added to the line.

The dividing heads have a ball bearing thrust on the worm shaft and rear end of the spindle and the headstock spindle has a threaded nose. There is a large tapered bearing which is adjustable for end play. The head tilts past 90 degrees. The worm wheel and alloy stress-proof steel worm cut to close limits for accuracy, and the worm wheel and worm shaft can be fully disengaged.

Each dividing head comes complete with three index plates.

For more data circle 93 on Postpaid Card

★ modern machine shop ★

FLAME-CUTTING TABLE

Cleveland Crane & Engr. Co., 6476 East 281st St., Wickliffe, Ohio, announces a flame-cutting table which should prove valuable to all shops that cut steel plate by use of a gas torch. The Steelweld Flame - Cutting Table was especially designed to overcome the high cost of repairing and replacing tables used for supporting plate during flame-cutting.

It is made of cast iron and machined to accommodate cast iron cones. Plates rest on the cones while being cut. Cast iron is used because it has proven highly resistant to heat damage.

The cones provide considerable air space between a plate and the table, thus minimizing the intensity of the heat of a burning-torch reaching the

Stop slow, bumbling driving methods

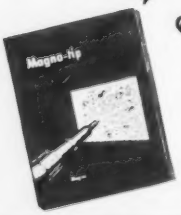
GO MAGNETIC

WITH

Magna-tip®

SCREW DRIVING ACCESSORIES

You can speed assembly operations and stop inefficient fumbling with Magna (Permanently Magnetic) bit holders, finders and sockets. Fit all power screwdrivers to hold screws, bolts or nuts firmly for one-hand driving. Hundreds of plants are now using them profitably. Ask your power screwdriver salesman for details.



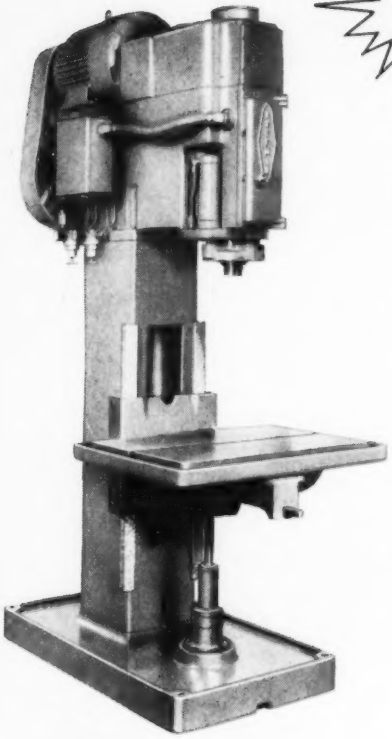
WRITE for manual on the complete line of Magna-tip bit holders, finders, sockets and hand screwdrivers. Dept. 92G4. Magna Driver Corp., 779 Washington St., Buffalo 3, N. Y.

For more data circle 499 on Postpaid Card

FOR HIGH SPEED PRECISION TAPPING CHOOSE THE

KAUFMAN

MODEL 10E-20



Six features of this new, precision-built Kaufman Tapping Machine are:

1. Lead screw control for accurate threads and maximum tool life. Maximum 4½" lead screw travel.
2. Rapid approach of spindles to work.
3. Clutch operated for faster operation – Reversing spindles at twice forward speed.
4. Six speed transmission providing spindle speeds of 80-350 RPM with 3-1 ratio or 160-700 with 1½-1 ratio clutch.
5. Units provided with 5-7½-10 H.P. Motors.
6. Speeds and H.P. available for highly efficient tapping from 5/16" through 2" NC taps or smaller taps with use of multiple head.

KAUFMAN

For additional information about the new Model 10E-20 or other Kaufman machines for single or multiple operation, write or telephone:

KAUFMAN MFG. CO.

551 S. 29th Street. Manitowoc, Wisconsin

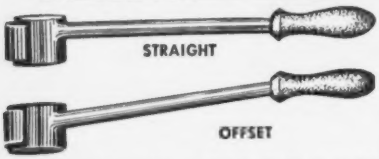
For more data circle 500 on Postpaid Card

Every TOOL ROOM NEEDS THIS BIG REID CATALOG

It's Free!

Send for this new 78 page catalog describing scores of needed tool room accessories and components

MALLEABLE MACHINE HANDLES



Finest and most complete available. Made in straight and offset types as shown. Also in crank type. Made in many sizes. Well proportioned. Neat in appearance. For severe usage. Low prices.

REID TOOL SUPPLY CO.
MUSKEGON HEIGHTS, MICHIGAN

For more data circle 501 on Postpaid Card

LINLEY RIVETERS

spin rivets noiselessly at low cost

•

Speed your riveting production with Linley Noiseless Riveters. We'll give you, without obligation, cost and time estimates of doing it the Linley way if you'll send us samples of parts to be riveted.

Linley Riveters will do rivets up to ⅜" in diameter in iron and cold rolled steel; larger sizes in brass, aluminum, etc.

Send for Bulletin R Today.

LINLEY BROTHERS CO.
Also Builders of JIG BORERS
671 State St. Ext., Bridgeport 1, Conn.

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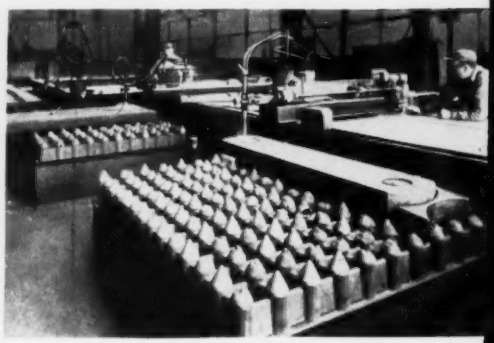

Cleveland Steelweld Flame-Cutting Table

table. Consequently, the table is seldom damaged. Only the cones are subject to injury when the flame strikes them but, because they are widely spaced, this situation occurs only occasionally.

Standard table sizes are 80 by 87 and 81 by 63 inches. Two or more tables can, of course, be fastened together to obtain larger table areas, where desired.

For more data circle 94 on Postpaid Card

★ modern machine shop ★

DIRECT DIAL DIMENSIONING SYSTEM

Diatrol, a direct dial dimensioning system for Spiramatic Jigmils, is announced by DeVlieg Machine Co., Fair St., Royal Oak, Mich. The system is a simplified and accurate means of presetting dimensions for automatic point-to-point positioning.

By eliminating the use of measuring rods, Diatrol allows direct dialing of positive or negative dimensions from any arbitrarily selected datum plane within the range of the control system.

The measuring portion of the system is capable of being calibrated to the ultimate in accuracy and the

NEW MUSKEGON "MICRO-FLOTE"

ADJUSTS *IN THE BAR* TO .0002!

Here at long last is a "floating action" reamer *you can adjust in the bar* to slash down time and increase accuracy! New Muskegon "Micro-Flote" reamers have extra-strong, extra-hard adjusting screws with National fine threads, plus a new silken-smooth sliding action on ground surfaces. You can adjust to .0002 without so much as loosening the locking screw on the bar! Our own personnel wouldn't believe it — until they saw it work. Send coupon for demonstration on your own equipment. No charge, no obligation.

- **New huskier, harder adjusting screw**
- **New silken-smooth adjusting action**
- **Eliminates removal of cutter from bar**
- **Introduces new era of faster, more accurate adjustment**
- **Will fit your standard bars**

I'M FROM MISSOURI, TOO
. . . contact me to arrange demonstration

Name:

Company:

Address:

City: State:

MUSKEGON
Tool Industries, Inc.

11th at Western Muskegon, Michigan

For more data circle 503 on Postpaid Card

UNIVERSAL DIVIDING HEADS

• Precision built to meet every requirement, Carroll Dividing Heads are the accepted standard in metal-working plants from coast to coast. • A unique optional swivel base makes possible speedy and accurate work settings to compound angles. This and other features convert a conventional Dividing Head into a Universal Work Head or Rotary Table.

Write for 8 page catalog giving complete details, etc.

Other Models 6" With or Without Direct Indexing.

10"-12" Universal Right or Left Hand Dividing Heads with or without Direct Indexing. Also with Spiral Drive.

CARROLL DIVIDING HEAD CO.

3525 Cardiff Ave. • Cincinnati, Ohio

For more data circle 504 on Postpaid Card

HYDRAULIC LIFT TABLES

Pat. Pending

Lexco portable adjustable height—hand or foot operated—saves you MONEY—TIME—ENERGY. For lifting and transporting heavy castings, dies, machine accessories and parts to machines and presses. Capacities 500 lbs. to 5,000 lbs. Special sizes available—also HYDRAULIC STRIP STOCK and DIE HANDLERS.

Write for free bulletins.

LEXCO ENGINEERING & MFG. CORP.

20 W. Chestnut St. • Souderton, Pa.

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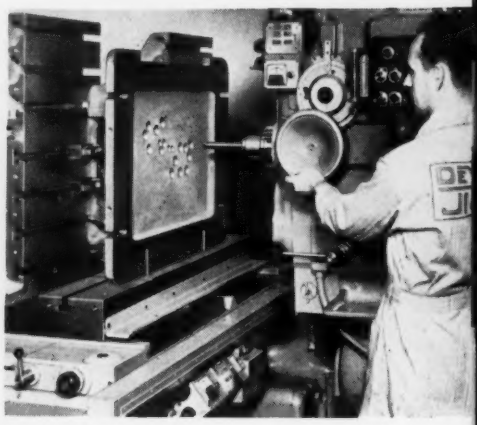
new shop equipment . . .



The Diatrol System for DeVlieg Jigmils

measuring, positioning and control elements are completely protected to insure continuous and troublefree performance.

For more data circle 95 on Postpaid Card

★ modern machine shop ★

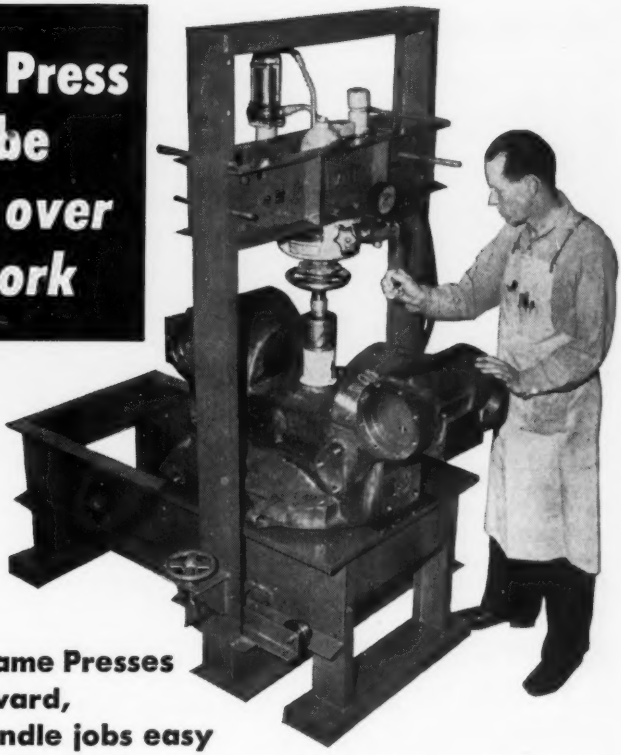
COLLET ACTUATOR FOR LATHES, GRINDERS AND BORING MACHINES

The Model 3A Collet Actuator, a non-rotating air cylinder used to operate collets, step chucks and expanding mandrels on lathes, grinders and boring machines, is announced by Power Grip, Inc., Rockfall, Connecticut.

The collet actuator, shown mounted on a small precision boring machine, provides uniform, controlled holding pressure when machining or grinding precision parts. A flow control valve prevents draw back of the work when the collet is closing. The hollow draw tube permits work, tools or coolant to be passed through the spindle.

The actuator consists of a stationary aluminum air cylinder, connected

THIS Press can be moved over the work



DAKE

Movable Frame Presses make awkward, hard-to-handle jobs easy

Here is the hydraulic press you need for work on awkward, heavy parts, and for handling large straightening jobs. Parts can be loaded on the work table with a hoist or fork truck—then the frame and workhead are centered over the job. The channels and workhead are easily raised or lowered if necessary to accommodate for work height.

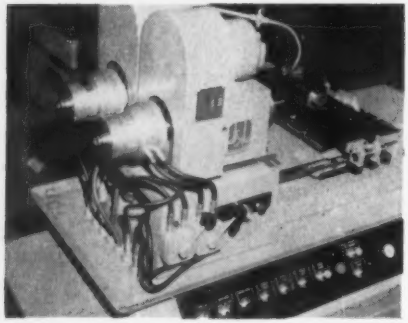
DAKE Hydraulic Presses with movable frames are designed for hand, air, or electric operation. Capacities range from 25 to 600 tons. For detailed information, write for Bulletin 269.

In addition to conventional hand, air and electric hydraulic presses, Dake makes gap type, guided platen, and other special purpose presses.

DAKE CORPORATION, 612 Robbins Road, Grand Haven, Michigan

DAKE PRESSES

For more data circle 506 on Postpaid Card



The PowerGrip Model 3A Collet Actuator

through ball thrust bearings to the machine spindle and draw tube. The thrust created by the air cylinder is transmitted through the bearings to the draw tube. The actuator mounts directly on the spindle and does not require an adapter plate. This reduces the overhang beyond the spindle. Vibration is reduced to a minimum, since only the adapters and inner races of the bearings rotate.

For more data circle 96 on Postpaid Card

★ modern machine shop ★

TWO NEW SIZES ADDED TO SWIVEL JAW VISE LINE

Aircraft manufacturers and other close tolerance toolmakers can now obtain swivel jaw vises in two new sizes from Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. Designed to hold tapered or irregularly shaped workpieces, the vises are now available in 3½, 4½ and 6 inch jaw widths.

For straight clamping action, the vise is equipped with a tapering locking pin which holds the rear jaw accurately parallel with the front jaw. When it is desired to secure angular workpieces, the locking pin is quickly and easily removed by inserting an

Mahr

50 Millionths Reading

SELF-CENTERING

BORE GAGES

Check bores for size, out-of-round and taper in any spot and to any depth within range of instrument to an absolutely reliable accuracy of

50 MILLIONTHS of an inch

THIS HIGH PRECISION INSTRUMENT IS AN INEXPENSIVE, ACCURATE AND DEPENDABLE

INTERNAL COMPARATOR

Small Bore Gages

RANGE .060" TO .160" PRICE **$126.00**
Complete in Hardwood Case

RANGE .160" TO .280" PRICE **$110.00**
Complete in Hardwood Case

OTHER SIZES UP TO 10"

GUARANTEED Mahr QUALITY

IF NOT AVAILABLE AT YOUR FAVORITE SUPPLY HOUSE - WRITE TO US FOR ILLUSTRATED FOLDER.

MEASURING HEADS ARE HARDCHROME PLATED FOR MAXIMUM WEAR

MAHR GAGE CO., INC.

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HEADQUARTERS FOR PRECISION MEASURING INSTRUMENTS AND FINE TOOLS

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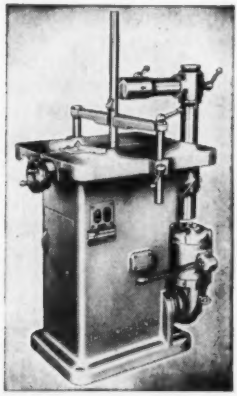

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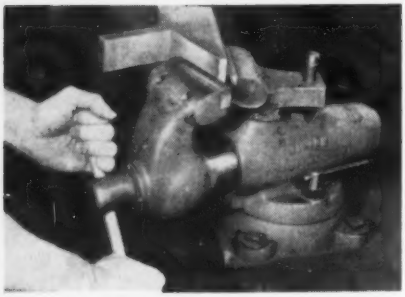

Wilton Swivel Jaw Vise is shown in use

attached drift pin in a unique horizontal relief hole just beneath the lock pin. With the locking pin out, the rear jaw of the vise will traverse an arc of 120 degrees. The vise is then capable of clamping almost any shape securely.

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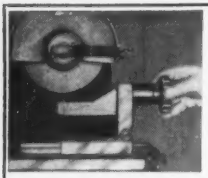
DRILL HEAD DRILLS ANGLE AND STRAIGHT HOLES SIMULTANEOUSLY

Thriftmaster Products Corp., 1034 North Plum St., Lancaster, Pa., recently built the special fixed center, ball bearing angular type drill head shown in the illustration.

This designed-for-the-job head drills holes at an angle at the same time straight holes are being drilled parallel to the direction of machine feed. The ten spindles are equally spaced in two straight rows. To permit drilling of all holes radially, each pair of spindles is at an 11 degree angle with the adjacent pair. An included angle of 44 degrees exists between the pairs of outside spindles.

In operation the main body of this head remains stationary with the spindles being fed into the work through linkage by the upper casting attached to the drilling machine. To



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outperforms them all

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HEIMANN TRANSFER SCREW SETS

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FOR ANY WORK ON ANY MACHINE TABLE

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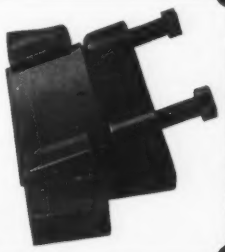

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Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.

The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

SLEEVES MADE IN FOLLOWING SIZES:

3-16, 1-4, 5-16, 3-8, 7-16, 1-2, 5-8, 3-4, 1"

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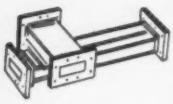

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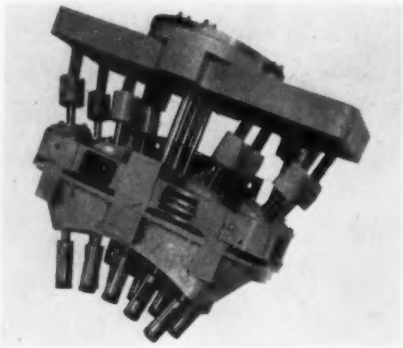
new shop equipment . . .



Special Fixed Center Thriftmaster Drill Head

provide adequate support, the head contains two guide rods and a machined pad.

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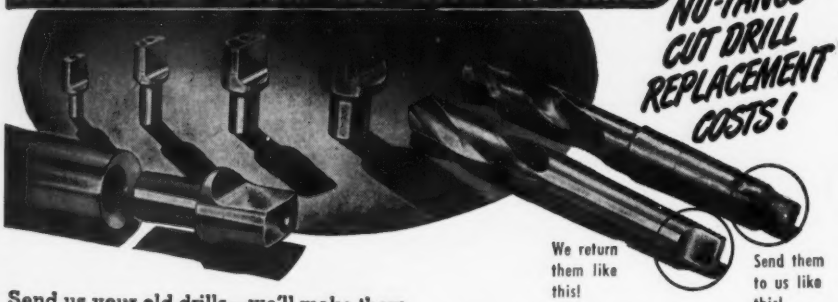
NEW DRILLS FROM OLD WITH NU-TANGS



Send us your old drills—we'll make them new again at a fraction of the cost of a new drill! Exclusive NU-TANG* process replaces twisted or broken tangs with brand new tangs of correct size — and with GUARANTEED ORIGINAL STRENGTH. No welding—No distortion —No shortening of drills—No sleeves.

Any drill, reamer, or other tool with a Morse taper in sizes 2 to 6 can be repaired perfectly this quick new way. Delivery—One week. Used by many leading industrial plants. Amazingly low cost—satisfaction guaranteed! Send for complete information.

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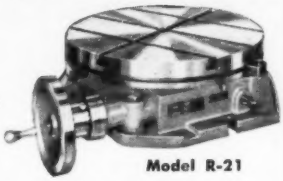

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6 Sizes • 8 Models

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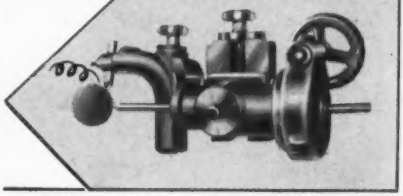

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For machining of CONVEX and CONCAVE surfaces on any lathe of standard design.

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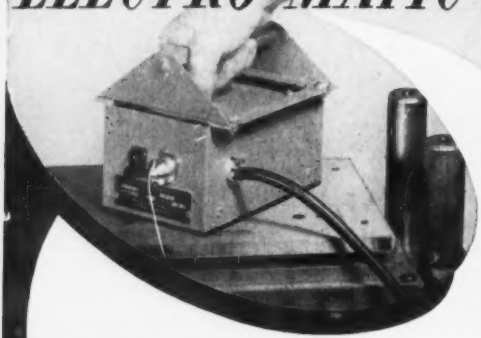
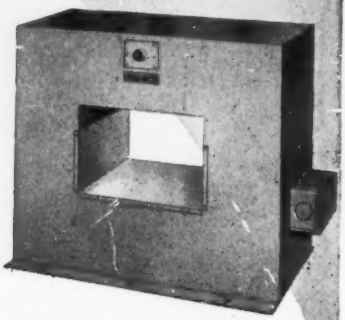
Demagnetizing is essential to tool room and assembly work. A size and style for every application; guaranteed to do the job.



SURFACE TYPE for Continuous Duty. Work by Simple contact. Operate on any A. C. voltage. A size for every purpose.



LOOP THROUGH TYPE for continuous or intermittent duty.

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new shop equipment . . .

PRESSURIZED MIST COOLANT SYSTEM

Trico Fuse Mfg. Co., Milwaukee, Wis., announces a system that delivers coolant mixture under pressure to banks of machinery or a large number of stations. As many as 30 nozzles, to a height of 15 feet or parallel distance of 100 feet, can be serviced from a single dispenser.

The specially designed control valve assembly shown is mounted singly or in gangs, at any desired location and connected with ¼ inch o.d. tubing to one central 5 gallon pressurized dispenser, which can be installed anywhere. Only two lines lead from the dispenser, and the valves are located close to the work. Additional valves can be added later, if they are needed. Coolant is fed under pressure to all valves, assuring positive delivery at the tip of each mist generating nozzle. Air and liquid lines are individually adjustable to feed from a solid stream to a very fine invisible mist; or compressed air for cooling only. Lines not needed can be shut off entirely without affecting other valve adjustments.

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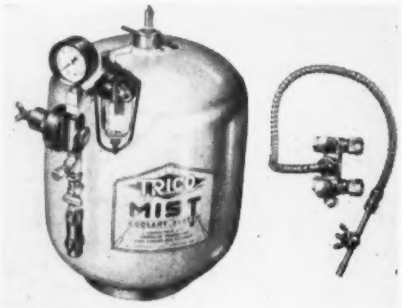
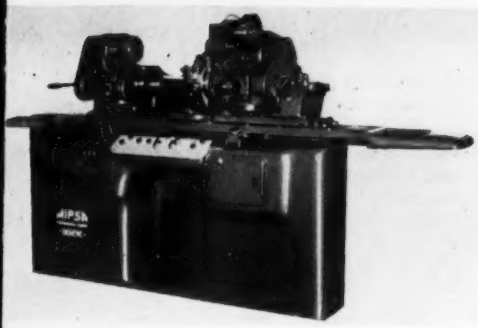


Trico Pressurized Mist Coolant System



The Mipsa Universal Grinding Machine

UNIVERSAL GRINDING MACHINE

Alina Corp., 122 East Second St., Mineola, L. I., N. Y., announces the Mipsa Universal Grinding Machine. It offers a completely new concept in grinding that will enable increased production without any sacrifice in accuracy. Features include: fully hydraulic operation, double swivel wheel head that permits simultaneous and accurate grinding of shoulder and o.d., additional grinding wheel that can be mounted on wheel head for flange and similar grinding, supersensitive in-feed, automatic gaging and mating and automatic wheel dressing.

For more data circle 101 on Postpaid Card

NEW PROCESS FOR THE CONSTRUCTION OF CUTTING TOOLS

Spiral Carbide Tool Co., 12931 Artesian St., Detroit 23, Mich., announces a different tool make-up process. This method uses a new approach to tool construction and eliminates a number of basic machining operations. It is said to be applicable to many types of tools, including both the carbide and high speed steel types.

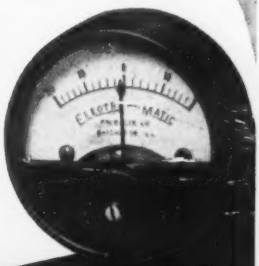
and MAGNETIC FIELD INSTRUMENTS

RESIDUMETER

A highly sensitive instrument, designed to determine and register magnetic fields in any work piece. Effective on all types of metals — bearings, races, plug gauges or any metal piece that may have become magnetized

MAGNETIC FIELD INDICATOR

An instrument to indicate residual magnetism in any piece below a negligible degree. Operates by simple contact . . . no electric.



Manufacturers of: NEUTROL NEUTROLATOR NEUTROFIER

ELECTRO-MATIC PRODUCTS CO.

2231 North Knox Avenue Chicago 39, Illinois, U.S.A.

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new shop equipment . . .

This tool was made by a new type of process

These new type cutting tools are made up, using a preformed metal wafer construction. Wafers are fabricated with the major geometrical configurations of cutting tools already incorporated into their design. They are then assembled on arbors of various sizes, corresponding to standard sizes, lengths and styles of tools already in use. Either high speed steel or carbide cutting tips are placed into appropriate cutouts and the entire assembly is then brazed into a solid mass.

The improved tool performance is said to be due to the increased density, which acts as a vibration dampener, with a tendency toward the elimination of tool chatter that is caused by vibrations developed by the machining operations.

It is claimed that tool life is improved because the construction allows for a better dissipation of heat at the cutting edges.

Spiral Carbide Tool Company will manufacture and market its own line of tools which are made by means of this new process and the company will also license other tool manufacturers who are interested in adding this new process to their particular manufacturing operations.

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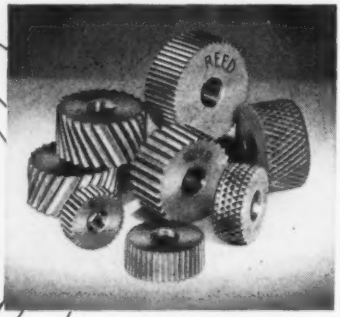
REED

KNURLS

CIRCULAR and DIAMETRAL PITCH



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Made to Order

We're constantly helping manufacturers solve their special knurling problems. Let us help with yours. Prices for special knurls quoted upon receipt of blueprints or detailed specifications.

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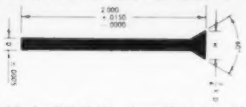

All tool steel Rockwell C 58/60 — honed finish, no pickup — heads left soft and are guaranteed uniform. Attractively priced at $12. to $19. per C. We manufacture 103 and stock 103 sizes for immediate delivery.

Available through our distributor or order direct.
Write for complete prices and details.

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30 YRS. SERVING INDUSTRY

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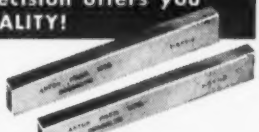
and only precision offers you HIGHEST QUALITY!



now is the time to put your OLD STEEL PARALLELS to "LIKE NEW"

conditions and to be ready for the big push.

For the first time Anton Machine Works offers to regrind your old parallels to the following tolerances:

- Parallelism and straightness over length of 6" ±.0001
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ANTON MACHINE WORKS

1226 FLUSHING AVE., BROOKLYN 37, N. Y.

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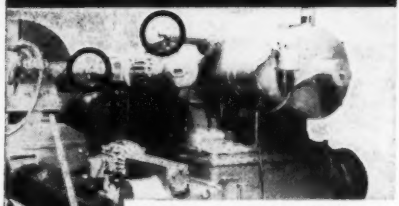
Lowell Series 20 Wrench adjusts stroke length and mold height on Fellows "6-200" injection molding machine.



Durable, fast-action Series 20 wrench has many uses on a Niles 72" Heavy Engine Lathe.

SPEED UP

SET-UP TIME
***with* LOWELL**
REVERSIBLE RATCHET
WRENCHES

A handy and efficient time saver for many shop jobs is this reversible ratchet Series 20 gear wrench.

Its unique feature of ratchet control from the *end* of the handle is a fast-action aid in speeding set-up time. Just a twist of the knurled knob reverses the ratchet . . . and hands are always kept clear of moving parts.

Except for some improvements of internal mechanism and appearance, this is essentially the same Lowell wrench used by machine tool builders for over 50 years!

Gear sizes from ¼" to 2¾", square or hex; handles from 7" to 36" in length.

WRITE FOR BULLETIN MED-1

LOWELL WRENCH CO.
Dept. M-85 Worcester 8, Massachusetts

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new shop equipment . . .

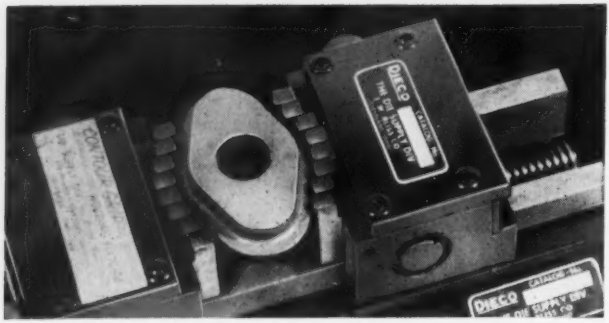
HAND SPRING CLAMP

A hand clamp with pivoting stainless steel toothed jaws is now being marketed by Arvids Iraids, 5930 Argus Road, Cincinnati 24, Ohio. As shown in the accompanying illustration, the clamp is particularly suited for holding together angular or irregular shaped workpieces preparatory to fastening by means of tack welding. It can be used to hold workpieces together during drilling or other machining operations.

The clamp is constructed of heavy gauge cold rolled steel, shaped with contoured handle which conveniently fits the user's hand. A tempered coiled spring located inside the handle provides for a pressure of 14 lbs. between the jaws of the clamp to firmly hold or grip workpieces. The standard pivot jaws with which the clamp is equipped are 1¾ inches in length. They are made of stainless steel and have a double row of serrated teeth along the gripping or pressure edge. The toothed jaws readily take hold in the surface of parts made of "soft" metals, including aluminum. For hard metal surfaces, a layer of masking tape can be used to cover the gripping area into which the toothed jaws may "bite" to assure good holding action.

To prevent marring of some types of surfaces by the toothed jaws, a set of rubber guards is provided which may be slipped over the jaws. The clamp may be used with effectiveness on work pieces of wood or plastic materials.

CONTOUR GRIP



Set up any job in seconds

then take deeper cuts, faster feeds

Makes any tool more productive. Here's why:

Contour Grip is a standard fixture that holds any irregularly shaped part so tightly that you can feed faster and take deeper cuts. Use any type tool, eliminate need for costly special-purpose jigs and fixtures. Your operator sets up Contour Grip in seconds, then goes from piece to piece just by backing off the jaws, dropping the next piece in and tightening up. For long runs or short.

The secret of Contour Grip's strength is its individual steel fingers, each of which moves independently as it contacts the work. The fingers mold around the part, and then tighten up **giving greater holding power and a more positive grip than any ordinary fixture can.**

To learn how Contour Grip works and to see the various models available, see your local dealer or contact us direct we'll be glad to send our latest bulletin.

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Accurate Hole Transfer Made Easy With

NIELSEN TRANSFER SCREWS

Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods. 8 sizes, from 3/16" to 3/4" U.S.S. Inexpensive — Last for years.

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Detroit 19, Michigan

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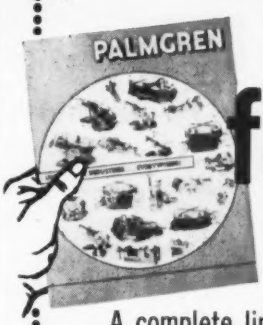

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A complete line of vises and rotary tables for production, tooling and maintenance.

68 different models and types. Vise jaw sizes from 1½" to 8".

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Chicago 17, Ill.

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GRIND-DEBURR-POLISH

Faster and Easier with a DREMEL MOTO-TOOL

No other grinder, regardless of size, power, or price can take the place of the Dremel Moto-Tool. It's lightweight (16 ounces) and handles like a pencil. Gives the operator extreme accuracy for close-tolerance work—and easy operation in tight places impossible to reach with large grinders. The Moto-Tool's high speed (27000 RPM) makes it ideal for use with small mounted wheel points. It's also handy for production deburring, and a perfect size and weight for women operators.

The Dremel Moto-Tool is an indispensable, all-purpose grinder for the tool room—a time-saver for the production line—an industrial favorite since 1936.

Order from Your Supplier or Write for Tool Catalog

Model No. 2 Moto-Tool only $19.95
Model No. 2 Moto-Tool Kit with 23 accessories and storage case $27.50

DREMEL MFG. CO., Dept. 229-K, Racine, Wisconsin

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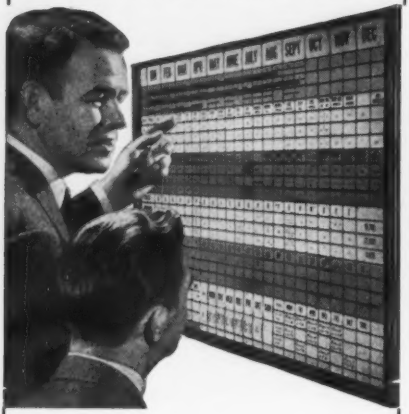

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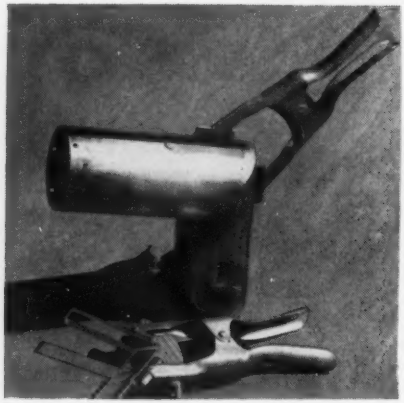

Examples showing how Iraids Hand Spring Clamps are used for clamping angular parts

The maximum width of jaw opening is 3½ inches. Overall length of the Iraids Hand Spring Clamp is 9½ inches.

Main features claimed by the manufacturer for this clamp are applicability to a wide variety of work, speed with which it can be used, and dependable and firm holding action.

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NOW A FASTER READING DIAL CALIPER

Newly designed for faster, accurate measurement. Engraved beam graduations simplify reading. Knife jaws permit inside measurements, easy outside and depth measurements—can be locked in position. All operating components are completely enclosed. Precision built from stainless steel and brass. Two models—6" at $39.00, 8" at $42.00. **Write Today for Free Literature. Dealer Inquiries are Invited.**

TITAN TOOL SUPPLY CO.

Box B, 1419 Hertel Avenue Buffalo 16, N. Y.

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LIGHTWEIGHT ASSEMBLY USES SLIP-IN CUTTING TIPS

A lightweight cutting assembly, which permits the use of slip-in tips, has been developed by Smith Welding Equipment Corp., 2619 Fourth St., Southeast, Minneapolis 14, Minn., for its Airline Torch.

The addition of this Airline "300" Assembly completes the conversion to slip-in tips of all of the current Smith torches. Slip-in tips eliminate the need for wrench tightening.

Two models of the "300" have been introduced —the AC305 with a 75 degree head and the AC309 with a 90 degree head.

The head and butt of the assembly are pressure forged of dense brass and machined to exacting standards. Gases are kept separate by O ring seals, until they mix in the slip-in tips. A Flo-Trol backpressure check valve prevents the causes of flashbacks. Lever control of cutting oxygen is provided.

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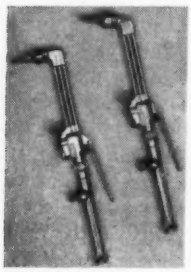

Models of Airline Cutting Assemblies

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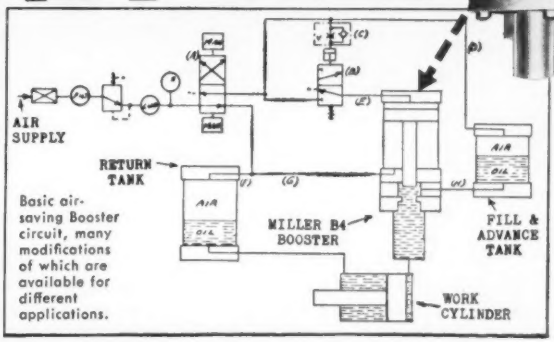
MEASURING MACHINE ELIMINATES SPECIAL TEMPLATES AND TOOLING

Pratt & Whitney Co., Inc., 25 Charter Oak Blvd., West Hartford, Conn., announces a numerically controlled

Up To 10,000 psi Oil from Shop Air

Miller AIR-HYDRAULIC BOOSTERS


AIR SUPPLY
RETURN TANK
Basic air-saving Booster circuit, many modifications of which are available for different applications.
MILLER B4 BOOSTER
FILL & ADVANCE TANK
WORK CYLINDER

No Pumps or High Pressure Valving Needed

Hook a Miller Air-Hydraulic Booster to your air line and get INTENSIFIED hydraulic power that you can vary and control at will and use for such common shop operations as punching, clamping, pressing, riveting, shearing, welding, crimping, testing, etc. Boosters save air, space, weight, require little or no maintenance and hold pressure as long as desired without additional power consumption. ***Models for immediate delivery.***

Write For Full Details

Miller FLUID POWER DIVISION
Fluid Ready Corp
7N023 YORK RD., BENSENVILLE, ILL.

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gaging machine, designed to check components of practically any shape at any desired number of coordinate points of their inner or outer surfaces.

It is stated by the manufacturer that complex missile shapes can be checked both quickly and accurately, even though hundreds of individual reference points may be involved.

Known as the "Data-Limit" 6 Coordinate Measuring Machine, this instrument has two gaging arms, with each arm capable of movement in the X, Z and Theta coordinates—horizontal and vertical movement, plus rotary motion around the X and Z coordinates. Operation is fully automatic. Input data, carried on an easily prepared perforated tap, is used to move the gaging arm and head to a reference point on the workpiece — and then to position the gage head at a desired series of points in space. At each point the gage head measures the deviation of the workpiece surface from its nominal location. The machine is equipped with digital readout, which makes it possible to store, record or mathematically process the gage data in almost any desired manner.

Use of a perforated tape eliminates the time and expense of preparing templates and other special gage tooling. As a result, part-to-part changeover is said to be fast, simple and economical; engineering changes can readily be incorporated at any time

ANNOUNCING

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Kit contains 80 wheels and points in the most popular sizes and shapes, equally assorted in four grit textures, coarse (C), medium (M), fine (F), extra fine (XF)... plus four mandrels for ⅛" chuck... packaged in plastic box, compartmented for fast selection. $7.50 complete.

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CRATEX *Free 8-page catalog available on request.*

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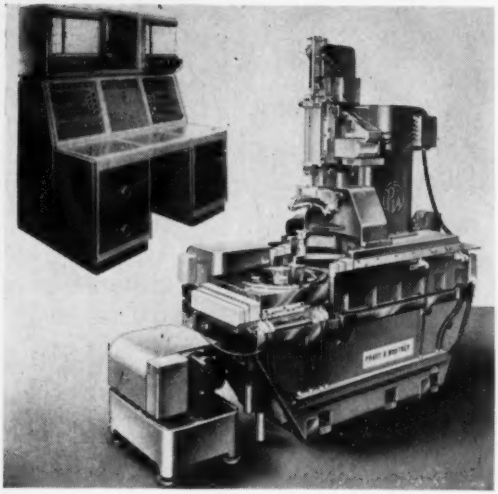

Pratt and Whitney Data-Limit 6 Coordinate Measuring Machine and operator's console

without causing any inspection bottlenecks.

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NEW SURFACE FINISHING CONCEPT

Announcement of a new surface finishing process for metals and other materials is made by Taft-Peirce Mfg. Co., Woonsocket, R. I. The term "Microstoning" has been given to the process in order to adequately describe its precise finishing characteristics.

Microstoning is accomplished by using a Supfina Machine Tool Attachment. It is an abrasive final finishing process that generates a controlled microinch finish on practically any material and, at the same time, corrects geometrical errors caused during previous machining operations. The process is equally well adapted to

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Leaves both hands free to work

Magni-Focuser—the binocular magnifier—reduces eye-strain and *prevents squinting*—thereby speeding production, increasing accuracy and minimizing the chance of errors and accidents.

Gauge reading, layout work, inspection, tool and die work are just a few of the jobs that need the Magni-Focuser. Speeds precision assemblies, blue print work. Restores the usefulness of the skilled hands of many older workers whose vision needs a seeing aid.

Magni-Focuser can help your plant produce better. Immediate delivery. 10-day trial without obligation. Return to us if not satisfied. $10.50.

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MAGNI-FOCUSER'S matched prismatic lenses give needle-sharp magnification. Comfortably light weight. Fits over regular glasses. Leaves both hands free. Normal vision may be resumed by lifting head.

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single piece finishing or to repetitive production work. Supfina attachments, which produce the Microstoning finishing, are most frequently used on engine lathes, although they are equally well adapted to vertical turret lathes, boring mills and even planers.
For more data circle 106 on Postpaid Card

No. 9681 Supfina Microstoning Attachment

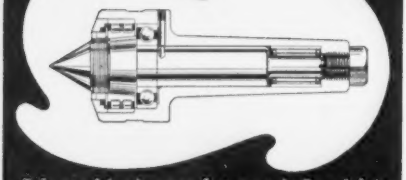
★ modern machine shop ★

CUT-OFF TOOL FOR LATHES AND SCREW MACHINES

General Machine Co., Inc., Emmaus, Pa., announces the "Non-Flex" which is a new type of cut-off tool for use on turret lathes and automatic screw machines. The tools are made in four sizes for use on bar stock of 2½, 3½, 4½ and 6 inch maximum diameters.

A heavy, hardened steel support is located directly below the cutting tip. This provides extreme rigidity, permitting the use of any grade of carbide or tantung. Due to the rigidity, greater

NIELSEN
Heavy Duty
Live Centers



Adapted for heavy duty work. Precision type ball and roller bearings assure maximum capacity for high speed production and long service.

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Rowbottom for Cams

When it comes to CAMS...come to ROWBOTTOM

Take advantage of Rowbottom "know-how" and exclusive specialized service in CAM production. Any quantity . . . any type . . . promptly . . . economically. Rowbottom will contract to make your cams, handle your rotary profiling or furnish the machines. New literature available immediately.

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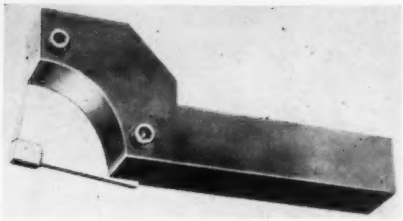

"Non-Flex" Cut-Off Tool is shown above

speeds and feeds are possible and tool life is greatly increased. Both holders and blades are precision ground to an accuracy of 0.001 in all dimensions. This permits any number of blade changes, without losing original setting.

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★ mms ★

1 AND 1¼ INCH CONTROL VALVES

Galland-Henning, Nopak Division, 2753 South 31st St., Milwaukee 46, Wis., has recently announced that Nopak-matic Valves are available in two new standard pipe sizes and in three standard body styles; master, single solenoid and double solenoid.

These 1 and 1¼ inch valves have extremely large body orifices, free from obstructions, capable of passing a large volume of air or hydraulic fluids.

They are recommended for the fast cycling of large bore cylinders.

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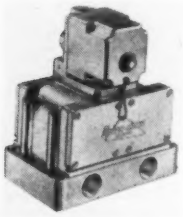

Nopak-matic Valve

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Blue Devil® SOCKET SCREW PRODUCTS
Most Blue Devil customers use one or two of these Socket Screw Products. Actually there are 10, including Dowel Pins and Socket Keys. Next time you need something in sockets, use both hands... dial your nearby Blue Devil Distributor.
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STANDARD STOCK STRAIGHTENERS
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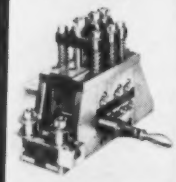

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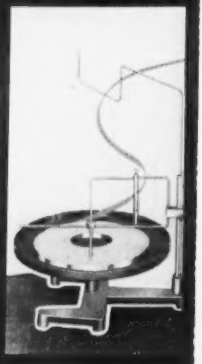
Low cost, operated by press ram, independent of die. Easily bolted to press.

FOUR MODELS
M1 takes stock 3" wide .062 thick
M2 takes stock 6" wide .062 thick
M3 takes stock 10" wide .100 thick
M4 takes stock 12" wide .100 thick

AUTOMATIC STOCK REEL
Operates by natural spring of uncoiling stock. Platen turns on ball bearings. No motor, belts or sprockets. Loop of stock stops slippage, kick back, and over run. Speed limits controlled only by feed.

Write Now for new catalog showing prices and complete line of Equipment.



DURANT Tool Supply Co.
1-15 THURBERS AVENUE
PROVIDENCE 5, RHODE ISLAND

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The Buck 15 Inch Aluminum Power Chuck

15 INCH POWER CHUCK

Buck Tool Co., 914 Schippers Lane, Kalamazoo, Mich., announces a 15 inch power chuck that a man can lift. The illustration dramatizes the 40 percent weight saving of this gibbed-keyway aluminum body chuck. The chuck spindle weight is only 145 pounds.

Several performance improvements are said to come from the difference in weight — quicker starts, higher gripping power at high speeds (master jaws exert 40 percent less centrifugal

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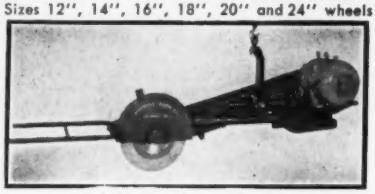
Sizes 12", 14", 16", 18", 20" and 24" wheels



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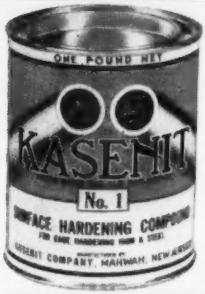

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NON-POISONOUS
CASE HARDENING

Indispensable for Tool Rooms, Machine Shops, Schools, etc. Now available in 1, 5, 10, 25, 50 and 100 lb. containers.

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Est. 1912
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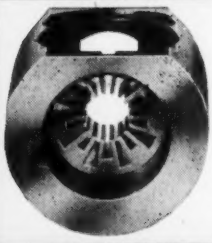
HOBBING!

Here At Last!

Intricate Shaped Cavities are Produced by Cold Extrusion to Precision Accuracy . . .



Cavities that would be totally impractical to machine are now produced in a single operation and in any quantity.

Technique applied to copper, aluminum and hobbing steel.

Lower cost—closer tolerances.

Send drawings of your designs for quotation to:

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New Haven 7, Connecticut

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force), less power need, less machine brake wear and maintenance.

This chuck is made with the Buck Adjust-Tru principle, which guarantees precision within 0.001 inch. Another feature is the gibs under each keyway to take up wear and triple useful precision life of the chuck.

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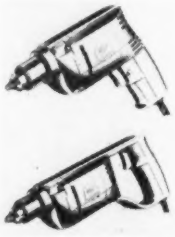
PORTABLE ELECTRIC DRILLS

Complete new styling with comfortably contoured spade-grip or pistol-grip handle in each model, increased power with 3 ampere rating or more in every capacity, and light weight are features of the new line of ¼, ⅜ and 5/16 inch portable electric SpeedDrills, announced by SpeedWay Division, Thor Power Tool Co., 1421 Barnsdale Rd., LaGrange Park, Ill. The SpeedDrill line consists of seven basic models.

Standard features include polished die-cast aluminum housing, precision geared chuck with key, 10 foot three - conductor lead cord with adaptor, momentary contact switch with locking pin for continuous duty, and SpeedWay's universal series—wound motor for a.c. or d.c. use.

Both the spade-grip and pistol-grip handles are contoured to fit the hand



Two Thor SpeedDrills

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3 PLANT LOCATIONS

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comfortably and, with the SpeedDrills weighing only 4¼ to 4¾ pounds, give balanced control.

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ACTUATOR AUTOMATICALLY OPENS AND CLOSES CHUCKS AND COLLETS

A highly versatile non-rotating collet actuator, that automatically opens and closes chucks and collets, provides dependable holding power for bar or chucking work, in addition to offering numerous other economic and operating advantages, is available from Acme Industrial Co., 214 North Laflin Ave., Chicago, Illinois.

This actuator couples non-rotating design with long life. Instead of subjecting machine spindle guide bearings to both spindle and gripping loads, the collet clamping forces are transmitted through the actuator itself, eliminating substantial wear from the spindle bearings and resulting in long life.

This non-rotating collet actuator can be adapted to lathes, screw machines or machines up to 1½ inch bar capacity, utilizing a collet or chuck for workpiece gripping. Attached directly to the shaft of a machine, the unit requires no additional fixtures. New design means no limit on spindle speeds, simplicity of operation, minimized down time and maintenance, all at economical cost. The non-rotating cylinder construction eliminates air leaks and vibration and may automatically function without

INTERNATIONAL HARVESTER COMPANY
SYLVANIA ELECTRIC COMPANY
EX-CELL-O CORPORATION
CARBORUNDUM CORPORATION
PRATT & WHITNEY CO., INC.
BUICK MOTOR DIV., GMC
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GENERAL ELECTRIC COMPANY
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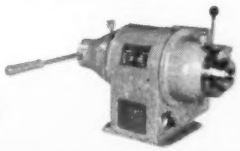

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MANUFACTURING CORP.
4501 Alpine Ave., Cincinnati 42, Ohio

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STURTEVANT

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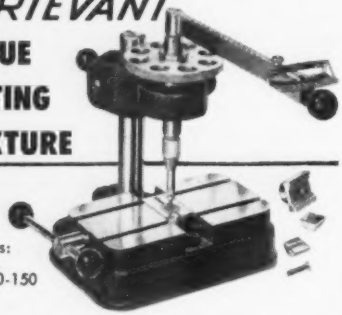

Capacities: (0-200 in. lbs.) or (0-150 ft. lbs.)

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DESIGNERS **INSPECTORS**
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Write for Bulletin TTF 585

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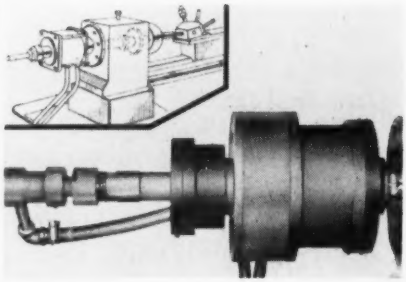

The Acme "Long Life" Collet Actuator

an operator in attendance. Merely by removing the collet and inserting an adapter, a machine may be changed from collet to chuck operation without removing the actuator.

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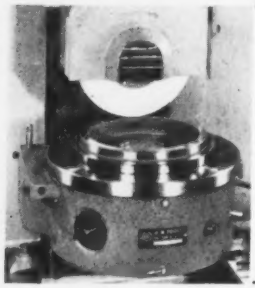

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—a precision grinding fixture for surface grinders and jig grinders.

- Save Time — Save Money
- Grind Dies, Molds & Special Rings
- Precision grinding as well as rough work
- Extreme accuracy — less than 20 millionths on many parts
- Variable speed — forward and reverse
- Sets up vertically for checking and ID-OD grinding
- Disengage clutch for hand work or indicating

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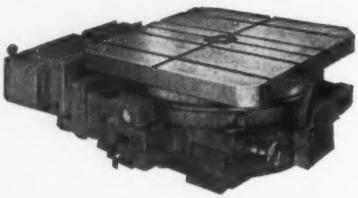

FASTER set-ups and positioning

You save set-up and positioning time with Gilbert rotary tables. *Hand-indexing:* 36″ and 50″ square or round. *Power rotary* and *power feed:* 36″, 50″, 60″, and 72″ square or round. Special tables built to your requirements. For complete descriptions and specifications, *write for Bulletin 854.*

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CLOSE TOLERANCE IN ONE PASS

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The famous

VIMCO *Lights*

brighten every corner of industry

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Since 1919

DEPT. A HOLLAND, N. Y.

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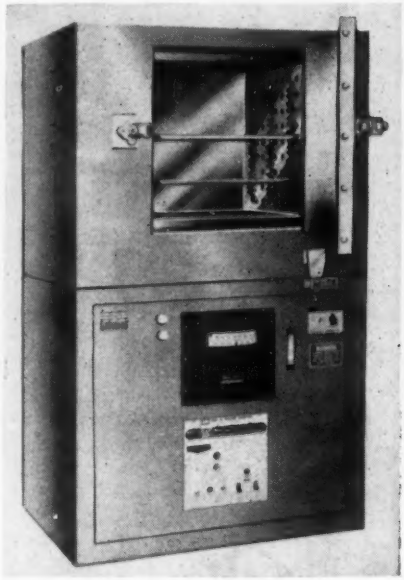

The Blue M Con-Wate Ultra-Temp Oven

MECHANICAL CONVECTION ULTRA-TEMP OVENS

Blue M Electrc Co., Blue Island, Ill., announces its Con-Wate Mechanical Convection Ultra-Temp Ovens, with temperature ranges from 66 to 649 degrees C. and actual control point

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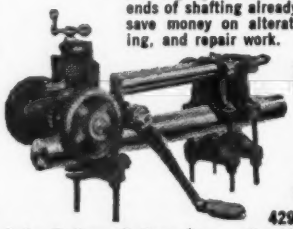
Mill keyways in the run or on the ends of shafting already erected—save money on alteration, erecting, and repair work.



ALSO Planer-type MILLER up to 144" table length.

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ONE TOOL HOLDER DOES THE WORK OF TEN

ONE tool holder for all positions . . . No tool chatter . . . can do internal boring or internal threading...Ideal for carbide tools . . .

Bit sizes: ¼", 5/16", ⅜", 7/16", ½", ⅝"

Furnished with Cobalt Bits

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Introducing NEW series

15" ROTARY TABLE—STD.

ROTARY TABLES _____ 5-8-12-15-18-24" sizes both standard and dial indexing types

ADJUSTABLE TILTING TABLES _____ #0-1-2

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INDEX CENTERS—multiple spindle

SPECIAL MACHINES—designed and built

See your dealer or write for bulletins

The John B. Stevens Company

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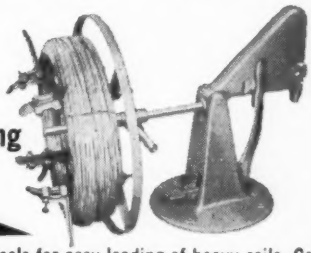
3 TYPES—8 MODELS



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Portable reels for easy loading of heavy coils. Coil Capacity: 150, 225 and 525 lbs., respectively.

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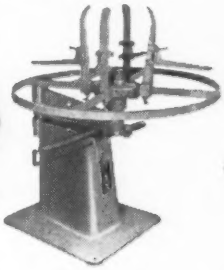
Oscillating motion eliminates slippage of stock. Coil Capacity: 175 and 250 lbs., respectively.



3 Stationary Base Reels

Economical reels for general-purpose production. Coil Capacity: 75, 150 & 225 lbs., respectively

In addition to these standard models, we can build variations to meet special requirements. Write today for your copy of the Nilson Catalog on Wire and Ribbon Metal Stock Reels!

NILSON

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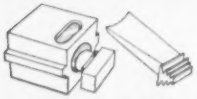

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money-saving application

• One of the many cost-saving applications of CERROTECHNICS involves the holding of irregular work pieces rigidly by nesting them in low-melting, non-shrinking CERRO ALLOYS. Illustrated is a jet engine "pinetree" turbine bucket held snugly—with Cerro Alloy—in a special fixture for grinding. After grinding, the bucket is removed by melting out the matrix in hot water . . . eliminating danger of annealing or burning the workpiece.

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PIONEERS and PACEMAKERS in their line

—head rivets from smallest to ¾" diameter cold steel, either by NOISELESS SPINNING or VIBRATING HAMMER method — fast, economically — types include Vertical and Horizontal Spindles, foot-power or automatic.

Free estimates of your work. Write for catalog today.

THE GRANT MFG. & MACHINE CO.
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of plus or minus 2 degrees F. An added advantage, in addition to the automatic proportioning control system, is the Con-Wate mechanical convection method of air circulation capable of maintaining constant weight of air and constant efficiency at all temperatures within the range. As a consequence, constant heat transfer results.

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ELECTRONIC GAGE FOR THE MEASUREMENT OF SMALL PARTS

The measurement of small ball bearing races poses several special problems. Very light gaging pressure must be used because the parts are thin walled or, in some cases, split and, therefore, easily distorted. Furthermore, it is desirable that the same gage check both inner and outer races of the assembly. A Gage, Model 247 B-549 announced by Federal Products Corp., 9147 Eddy St., Providence 1, R. I., is said to overcome these problems. It measures both inner or outer diameters accurately without remastering, and provides sufficient magnification to permit size classification in categories of 0.0001 inch. While it is

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Accurate and repeated reading in either direction. No mirror needed to read both sides or top. Non rust, non magnetic movement. .014" reading.

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A simple, sturdy machine designed to do its work in the easiest way, this bender is made of best quality malleable iron castings and has a hardened steel bending blade.

Capacity: 7/16" square or round iron
2" x 1/2" channel iron
2 1/4" x 5/16" flat iron

Catalog sheets on complete line available.

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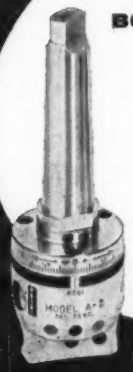

UNPARALLELED
- ACCURACY
- RIGIDITY
- SIMPLICITY
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REPEAT TO .0001" IN 30 SECONDS WITHOUT BACKLASHI CAN BE ADAPTED TO FIT ANY MACHINE

100% GUARANTEED! WRITE FOR CATALOG!

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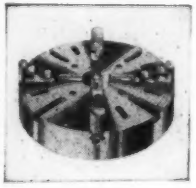
B.S.A. CHUCKS MEDIUM DUTY • PRECISION MADE IN ENGLAND

MODEL 580
Self - centering Geared Scroll UNIVERSAL • Three Jaws

Includes 1 set External Jaws, 1 Key, 1 set Internal Jaws, 3 Pinions, 3 Bolts.

IMMEDIATE DELIVERY

SIZE (in.)	WEIGHT (lbs.)	CHUCK BORE	PRICE
3"	3½	5/8"	$ 35.75
4"	8	1"	35.75
5"	12	1¼"	41.50
6"	17½	1 5/8"	48.00
7½"	29	2"	56.50
9"	42	2½"	71.50
10½"	62	3"	88.50
12"	88	3"	120.00
15"	143	3¼"	180.00
18"	200	4"	261.00
21"	262	4½"	320.00
24"	324	4½"	390.00



MODEL 550
4-JAW INDEPENDENT CHUCK

Includes 4 operating screws, 4 Reversible Jaws, 4 Bolts, 1 Key.

Order Today

SIZE (in.)	WEIGHT (lbs.)	CHUCK BORE	PRICE
4½"	8	1"	$ 30.50
6"	16	1 5/8"	35.00
8"	34	1¾"	51.00
10"	60	2"	62.50
12"	80	2¾"	74.50
14"	98	3"	84.00
16"	126	3"	105.00
18"	166	4"	140.00
20"	204	4"	165.00
22"	246	5"	205.00
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Dealers In Tool Room Equipment

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BARKER Bench Type Mill

for Production Milling of Small Parts by Unskilled Help

$345.00 As Shown

Screw Feeds Optional at Extra Cost.

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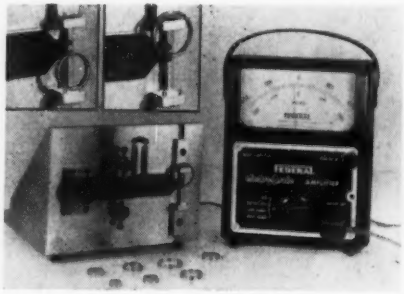

Federal Electronic Gage for small parts

designed primarily for ball track diameters of bearing races, the manufacturer states that it is very easily adaptable for measuring other small parts.

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PREVENTS HEAT TREAT SCALE . . . up to 1500°F. Brush on, heat, brush off. All metals.

cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time . . . P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.40 per gallon, f.o.b. Dayton.

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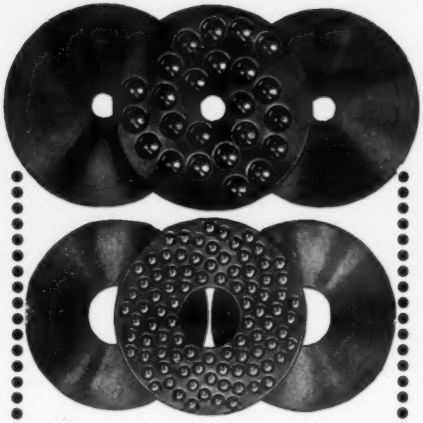

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STANDARD SIZES ARE SHOWN IN OUR GENERAL CATALOG, SENT UPON REQUEST.

• • *ALSO METAL BALLS* • •

THE GWILLIAM COMPANY

INCORPORATED 1912

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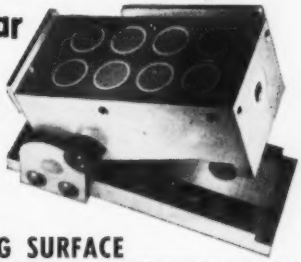
LOW COST 5" Magnetic Sine Bar



• ONLY $149.95 •

MODEL #1805M 5" x 3"

WORKING SURFACE ON PERMANENT MAGNETIC CHUCK

Positive locking provides rigid set-up for light machining operations. End and side plates allow accurate locating of pieces on magnetic chuck making it a versatile, low cost fixture. Ideal for production, inspection or tool room.

OTHER MODELS include 5" and 10" sine bars and plates, single and compound angles, plain and magnetic. Solid oak cases available.

The complete Bald Eagle line starts at $26.50, F.O.B. St. Paul. Order your sine bar or plate from your dealer or direct.

BALD EAGLE PRODUCTS DIV.

356 Cedar Street, St. Paul 1, Minnesota

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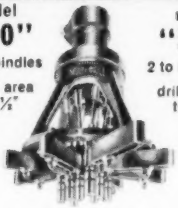
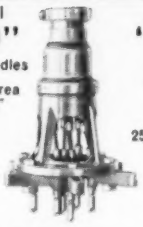
For LOW COST Hole Production

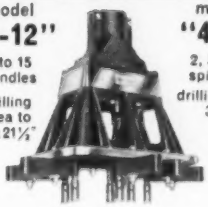
model "900"
2 to 8 spindles
drilling area to 22½"



model "500"
2 to 6 spindles
drilling area to 18½"

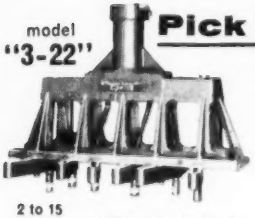


model "8-12"
2 to 15 spindles
drilling area to 25½" x 21½"



model "400"
2, 3 or 4 spindles
drilling area 3¾"

model "3-22"



2 to 15 spindles — drilling area to 35½"

Pick a MULTI-DRILL to Fit the Job

Commander MULTI-DRILLS — adjustable multiple spindle drill press attachments—are sold and serviced by a nation-wide network of Commander Distributors—experienced, helpful specialists in solving drilling and tapping problems. Write for the name of your nearest Distributor and the complete Commander Production Tool Catalog which contains full details on every MULTI-DRILL and many other production drilling and tapping tools.

104

Commander MFG. CO. 4224 WEST KINZIE STREET CHICAGO 24, ILLINOIS

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new shop equipment . . .

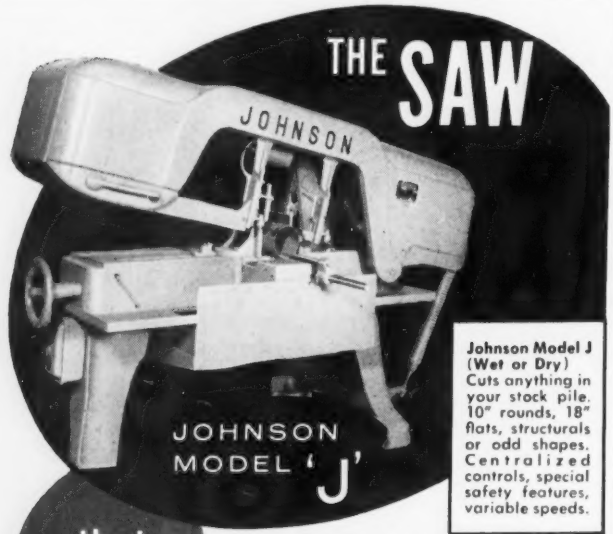
TUBE FURNACE FOR INDUSTRIAL PRODUCTION AND LABORATORY USE

The Sentry Co., Foxboro, Mass., announces its Model VL High Temperature Tube Furnace. This new model supplements the company's standard line of single and dual tube furnaces, offering longer, more uniform heated zones with larger tube sizes. VL furnaces were designed to meet the specific requirements for production in the electronics industry with the requirements of metal, ceramic, chemical, electrical and other industries in mind. In particular, broad application for the Model V-L furnaces is predicted in general scientific operations, wherein laboratory work is a prime consideration.

Model VL is described as an improved tube furnace capable of quick heating to a maximum temperature of 1,500 degrees C. or 2,750 degrees F., with close temperature control and a uniformly heated work zone.

The furnace is said to be capable of continuous efficient operation, as on the production of solid state electronic components, and to be equally capable of meeting the exacting requirements of laboratory research applications.

The Model VL High Temperature Tube Furnace is supplied in three different sizes with standard tube bores ranging up to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JOHNSON
JOHNSON
MODEL 'J'
Johnson Model J (Wet or Dry) Cuts anything in your stock pile. 10" rounds, 18" flats, structurals or odd shapes. Centralized controls, special safety features, variable speeds.
that costs you NOTHING!
True, you pay the low initial purchase price, but the big, rugged Johnson Model J is so well engineered, so dependable, so troublefree—so versatile, fast and accurate, that it quickly pays for itself in tangible savings. One Johnson metal cutting band saw . . . or a battery of them, will pay you big dividends in time, labor—smooth production and eliminate scrap.
Write Today . . . for your copy of the new Johnson catalog. All models and accessories described, illustrated in full.
Johnson MANUFACTURING CORPORATION
1011 Barnes Street Albion, Michigan
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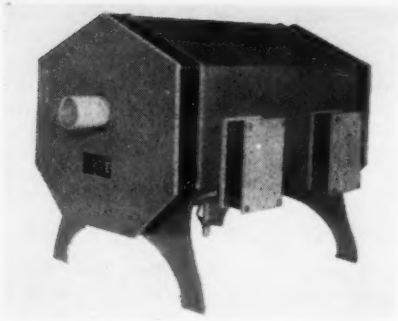

Sentry Model VL Size 9 Tube Furnace

3½ inches, and 18 inch long heating chambers.

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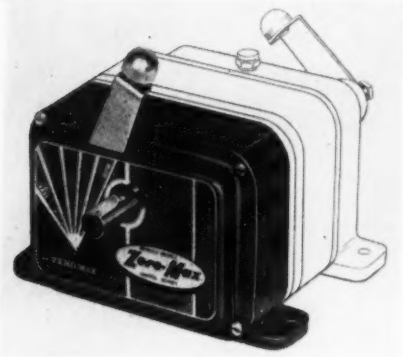
★ modern machine shop ★

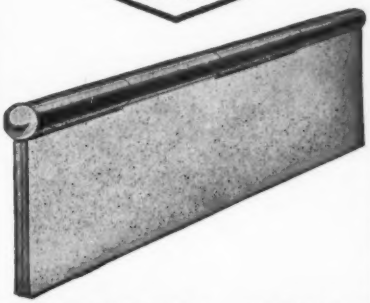
GEAR HEAD FORMS INTEGRAL UNIT WITH STEPLESS VARIABLE SPEED DRIVE

New design improvement of Zero-Max Gear Heads uses double spur gears to increase speed or torque. The new shape of the gear head housing provides for more rigid mounting to the stepless variable speed drives, manufactured by The Zero-Max Co.,



Zero-Max Gear Head has improved design

AUTOM



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Manufactured by

AUTO MOULDING & MFG. CO.

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CECOR *formerly Carnes*

COOLANT HANDLING EQUIPMENT

AX-450

ULTRASUCTION

DLO

removes chips, coolant sludge, oil from machine tool sumps. Large portable tank units offer filter option. Portable units, air or electric powered, collect sump waste for disposal or reclamation. Power heads convert 55 gallon drums into high suction Coolant Sump Cleaners. Six models for all applications handle abrasive waste without pump wear. Write today!

VERONA, WISCONSIN

COOLANT EQUIPMENT CORPORATION

For more data circle 575 on Postpaid Card

1936 Lyndale Ave., South, Minneapolis 5, Minnesota.

The gear heads increase the range of the smaller Zero-Max drives from 120 to 150 inch pounds of torque with variable speeds of 0-80 to 0-2,000 r.p.m. Available gear head ratios are 1 to 2, 3, 4, and 5 and from 5, 4, 3, 2 to 1, but torque is constant and speed is infinitely variable. The new design provides quiet operation and permits location of control conveniently at front of the rectangular case, which conforms to the Zero-Max shape. Also, the output shaft is located in the center of the unit on all models.

For more data circle 115 on Postpaid Card

★ modern machine shop ★

LINE OF SOLID CARBIDE TOOLS

Rotary Tool Industries, Inc., Dept. MM, 4461 West Jefferson, Detroit 9, Mich., announces a standard line of solid carbide radius mills, piloted countersinks, combination center drills and countersinks, internal grinding tools and center laps. These range from 1/16 to ½ inch. There are many adaptations to meet particular needs. In addition to the internal grinding tool, an arbor type is available. from ½ to 1 inch.

For more data circle 116 on Postpaid Card

Rotary Carbide Tools

- **End hit or miss center alignment without shifting tailstock or table**
- **Tip adjustment calibrated in increments of .0005"**
- **Provides micrometer control when used for straight or taper work**
- **Ideal when working on shafts or mandrels**
- **Replaceable carbide tip • Saves costly setup time**

With an Enco Micro-Set Adjustable Center, any operator can precisely align his work piece in a matter of minutes. Soon pays for itself in time and scrap savings. Try one and you'll see why they are called *"the most valuable turning or grinding accessory to come along in years"*. Available in popular Morse, Jarno and B&S tapers.

Write for complete catalog and nearest distributor.

Enco also manufactures a complete line of Precision Lathe Turrets and Tiny-Titan Magnetic Base Holders.

Enco MANUFACTURING COMPANY

DEPT. NO. 1109, 4520 W. FULLERTON AVE. • CHICAGO 39, ILLINOIS

For more data circle 576 on Postpaid Card

ROTARY SWAGING MACHINES

The Torrington Co., Torrington, Conn., has added five large sizes of rotary swaging machines to its line. With these added machines, rotary swagers made by this company will handle the reduction of solid material from 0.010 inch minimum up to 2¼ inches in diameter, and tubing up to 6 inches in diameter.

Previous machines had top capacities of 1 inch diameter solid stock or 2½ inch diameter tube. Lengths of tapers permissible on a single pass vary from 6¾ to 11¾ inches solid stock, and up to 14¾ inches for tubes.

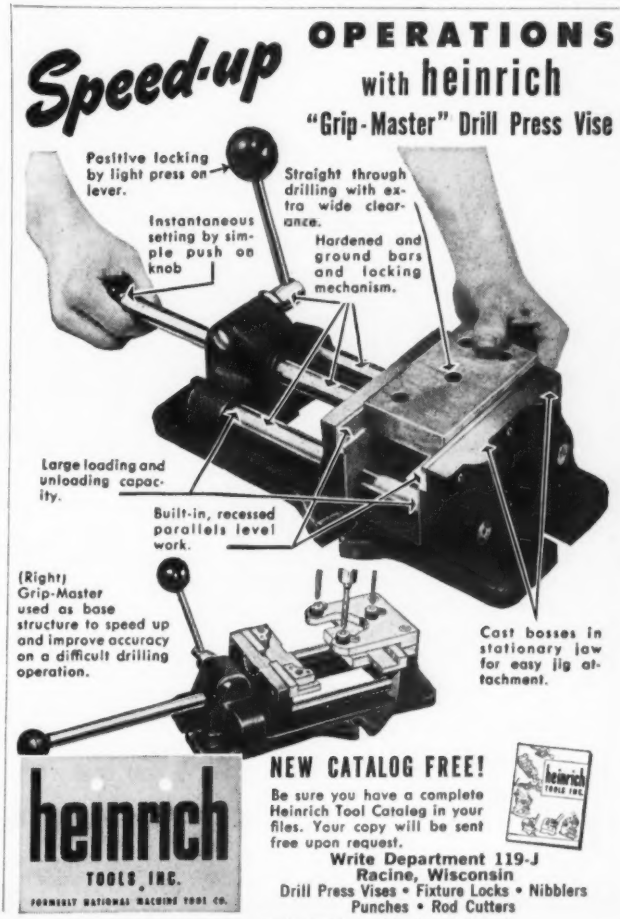
The swaging process is an economical means of forming, joining, reducing, tapering or sizing a wide variety of metals without chip loss. By refining and rearranging the grain structure, the swaging process increases the strength and surface hardness of both ferrous and non-ferrous metals, while automatically finishing to a smooth surface. Basic swaging operations hold close tolerances and are applicable to material of any length.

For more data circle 117 on Postpaid Card

PLASTIC TUBE AND INSULATED WIRE PRINTER

A plastic tube and insulated wire printer is announced by The Acromark Co., 9 Morrell St., Elizabeth 4, N. J., that accurately prints in color by a friction method at speeds up to 300 f.p.m. and repeats the markings at 9 inch intervals.

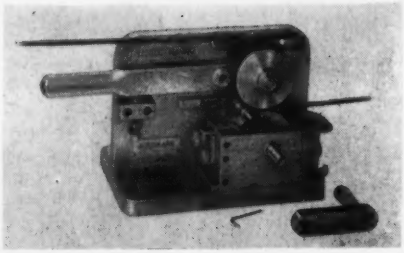
For continuous production line operation, this machine, designated as Model No. 482, incorporates an adjust-


Speed-up
OPERATIONS
with heinrich
"Grip-Master" Drill Press Vise
Positive locking by light press on lever.
Straight through drilling with extra wide clearance.
Instantaneous setting by simple push on knob
Hardened and ground bars and locking mechanism.
Large loading and unloading capacity.
Built-in, recessed parallels level work.
(Right) Grip-Master used as base structure to speed up and improve accuracy on a difficult drilling operation.
Cast bosses in stationary jaw for easy jig attachment.
heinrich
TOOLS, INC.
FORMERLY NATIONAL MACHINE TOOL CO.
NEW CATALOG FREE!
Be sure you have a complete Heinrich Tool Catalog in your files. Your copy will be sent free upon request.
Write Department 119-J
Racine, Wisconsin
Drill Press Vises • Fixture Locks • Nibblers
Punches • Rod Cutters

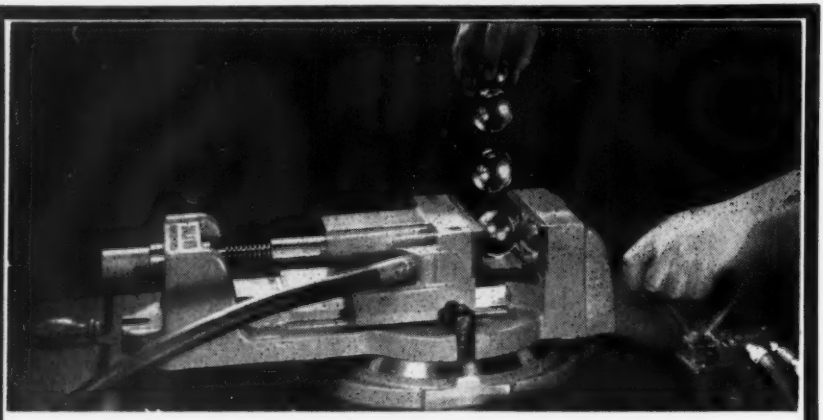
For more data circle 577 on Postpaid Card

ment lever for varied cable sizes or tube diameters and flattened thicknesses. Friction, created by passing the cable or tubing partially around a pressure roll and a rider roll, operates the well bearinged machine, which prints from an enclosed printing roll that is partially immersed in the automatic inking fountain.

For more data circle 118 on Postpaid Card



Acromark Plastic Tube and Wire Printer



FASTER MACHINE LOADING? MILOMATIC IS ON THE BALL!

In the time it takes a 1" steel ball to drop 6 inches. MilOmatic air powered hydraulic vises close automatically! This split second automatic clamping action is the perfect way to cut costs and increase production on high speed operations, in which efficiency depends on fast loading and unloading. You can use MilOmatic on any machine in your plant, as an automatic production fixture, and you can adapt them to any work piece with low cost jaw inserts. Get on the ball! Get the facts about MilOmatic today!

Attach this ad to your letterhead for free demonstration or new free catalog!

WILTON TOOL MFG. CO., INC.

Dept. MMS-109, SCHILLER PARK, ILLINOIS

Wilton Vises Are Sold By Leading Distributors Everywhere

For more data circle 578 on Postpaid Card

SAFETY FRAME INCORPORATES UNIQUE DESIGN FOR SIDE SHIELDS

Bausch & Lomb Optical Co., 893 St. Paul St., Rochester 2, N. Y., announces the M-70 metal frame safety glass. It combines a durable metal frame with Bal-Safe lenses for greater protection and smart appearance. The model features a redesigned, expansion type endpiece which allows easy assembly of lenses and side shields.

Bausch and Lomb M-70 Safety Glasses

A Wise Investment For Precision ...

***Pet/line* Measuring Instruments**

The built-in precision of Pet/line instruments — Comparators, Weighted Indicators, Depth Indicators, Magnetic Base Indicators — can help increase the efficiency of nearly all your checking-measuring operations. Big, Small, Inside, Outside — there's a Pet/line instrument to do your job better! They are easily set-up for quick, precise checking of depths, diameters, thicknesses, flatness, etc.

All Pet/line instruments feature the exclusive "Em-re" Dial Indicators—having measuring tolerances of as little as 1/5 graduation in any range. Find out how Pet/line Measuring Instruments can help you!

Write today for Catalog F.

PETZ-EMERY INC.

PLEASANT VALLEY, NEW YORK

For more data circle 579 on Postpaid Card

The design of the endpiece means that the same front can be used with or without side shields, and with no alteration of lens size. Assembly (or disassembly) of the shields is simplified and they are held in place as securely as if they were a permanent part of the frame. Side shields are attached merely by loosening the extra long endpiece screw, inserting the shield retainer in the eyewire groove and retightening the screw.

A choce of six types of shields is offered.

For more data circle 119 on Postpaid Card

★ modern machine shop ★

GRANITE ANGLE PLATES

Large black granite angle plates, made to extreme precision, are announced by Rahn Granite Surface Plate Co., 636 North Western Ave., Dayton 7, Ohio. Shown in the illustration is an angle plate 12 by 18 by 12 inches, having a 90 degree tolerance of 0.5 second, used to support a Moore Rotary Table in a vertical position. To provide more clearance over the machine table, a Rahn 3 inch parallel, having a f.i.r. tolerance of 25 millionths, is placed under the edge of the rotary table.

The extreme angular precision of the Rahn angle plate and parallel complement the precise settings of the Moore Rotary Table, thereby making a team which can produce precision parts

ALL NEW

MARK II
Shoplifter

New Low Price $195.00 *
New Capacity Full 750 lbs.

All lifters at this price *are not* the same. Compare and note the quality of the new Mark II, which now replaces the Type D Shoplifter. Full 750 lb. capacity can be handled safely anywhere on the platform.

No-drift, full control hoist unit. Raise or lower the load to fractional positioning. Built for years of continuous service with minimum maintenance. *Complete* safety features included at no extra cost.

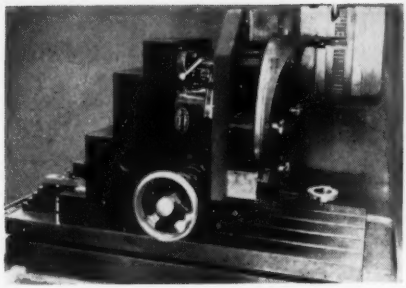
Applicable in small plants for "too heavy to lift loads" and in large plants to supplement powered equipment. The economical way to transfer molds and dies, unload trucks, stack in narrow aisles, or raise parts and machinery to working levels.

Write for specifications and other details.

*Priced f.o.b. Chicago

ECONOMY ENGINEERING
4507 W. Lake St., Chicago 24, Ill.

For more data circle 580 on Postpaid Card



Rahn Large Black Granite Angle Plate

made from magnesium castings for computing mechanisms to close tolerances on a production basis. The stability of the black granite assures that this accuracy will be retained.

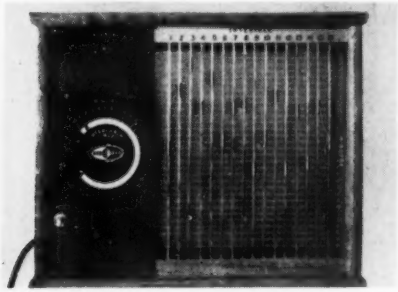
For more data circle 120 on Postpaid Card

★ modern machine shop ★

TIMER CONTROLS 16 INTERVALS

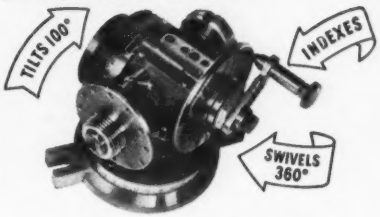
Precise control of up to 16 sequential time intervals such as are used in many mechanical and chemical processes is provided in the improved Model 52 Interchron Timer, introduced by Bald Eagle Products Div., 356 Cedar St., St. Paul 1, Minnesota.

From 1 to 16 intervals of up to 30 minutes each can be timed in 10 second increments and the entire program repeated through the use of a



Bald Eagle Model 52 Interchron Timer

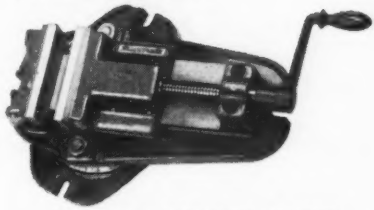
VERSATILITY



DIVIDING HEADS

6½" or 8" swing
Swivels in 2 planes
Holds work between centers, in chucks and collets.

ACCURACY



5" MACHINE VISE

Plain or swivel base
Precision ground screw
V-slides with adjustable gibs
Oil hardened and ground jaws

ECONOMY

Save time and money with Ellis tools. Write:

NICHOLS-MORRIS
CORPORATION
76-H MAMARONECK AVENUE
WHITE PLAINS, N.Y.

For more data circle 581 on Postpaid Card

reset control switch. The timer is driven by a synchronous motor through a minimum of moving parts. This insures accuracy to within 1 percent of the 30 minute maximum for each interval, in addition to long, trouble free operation.

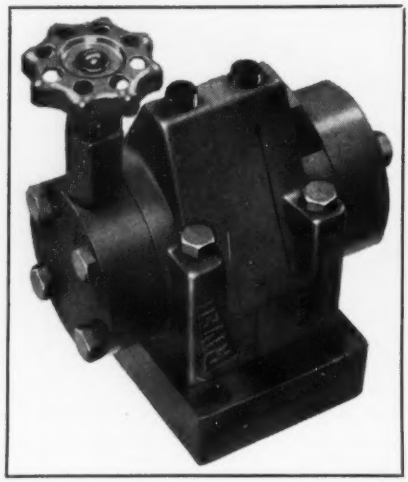
A feature is the easy adjustment of any one time interval independently without affecting the others, even though the timer is in operation.

For more data circle 121 on Postpaid Card

★ modern machine shop ★

PRESSURE CONTROLLED HYDRAULIC VALVE

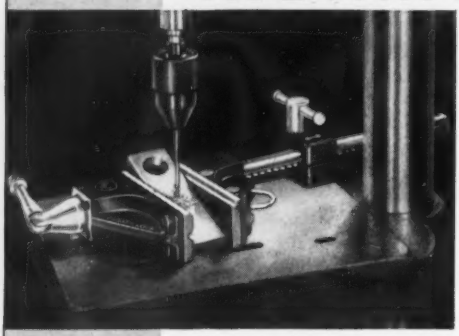
Rivett, Inc., Brighton 35, Boston, Mass., introduces a line of 3,000 p.s.i. pressure controlled hydraulic valves for such functions in a hydraulic circuit as relief, sequence, unloading, reducing and counterbalance. Known as the Series 8800, the pressure con-



Pressure Controlled Hydraulic Valve

Speed production . . . cut costs with

INSTANT CHANGE



AUTOMATIC KEYLESS CHUCK

Lets you change tools *in seconds* without stopping the spindle. One chuck does the work of several spindles, won't chew up tool shanks. The greater the torque, the tighter the grip.

DRILL PRESS VISE

Floats and locks *instantly*, positively, in any position on table. Holds work safely for accurate drilling and tapping. Two models: 9″ and 12″ capacities.

Write for illustrated folder and name of nearest distributor to AMF Tool Division, American Machine & Foundry Company, 224 Glenwood Ave., Bloomfield, N. J.

AMF **WAHLSTROM®** AUTOMATIC CHUCKS / **FLOAT-LOCK®** SAFETY VISES

For more data circle 582 on Postpaid Card

trolled valves contain many advanced engineering features, the most unique of which is the ability to obtain from a single basic valve assembly any one of the above functions. By stocking a single assembly, the user is able to meet any one of several different applications.

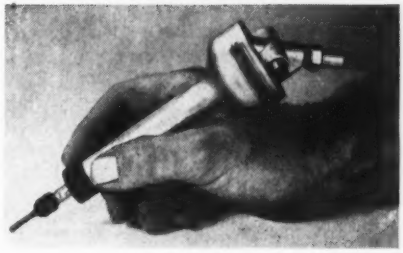
Full pressure rating can be obtained in all units at the point of valve opening. Pressure drop is minimized by providing liberal spool diameters, large openings, sizable internal passages to reduce turbulence.

For more data circle 122 on Postpaid Card

70,000 R.P.M. TURBINE GRINDER

A 12½ ounce, light duty turbine grinder is announced by Newage Industries, Inc., 222 York Rd., Jenkintown 26, Pennsylvania.

This Desoutter Grinder uses a balanced design body for comfortable handling. It comes complete in a fitted wooden case, with six mounted grinding wheels, chuck spanners, a head spanner, 10 feet of ⅜ inch hose with two connectors, jet plates and a dressing stone.



Desoutter Light Duty Turbine Grinder

The grinder runs cool, blowing chips away from work, and features automatic air shut off when it is disconnected. It is specially designed for tool and die makers requiring a grinder

Beverly THROATLESS SHEAR

Cut any Shape... STRAIGHT OR IRREGULAR

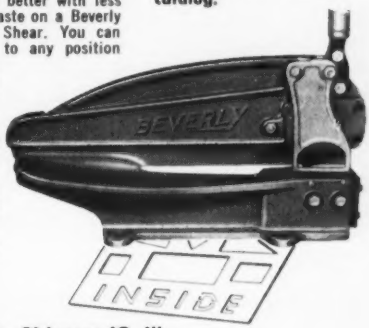
B-3 with Ball Bearing Hold Down

Make any cut — curved, straight or irregular, faster, easier and better with less material waste on a Beverly Throatless Shear. You can turn work to any position and make a clean cut as you go. Handles heavy gauges, with ease—lighter metals without distortion. 4 models — capacities 18 gauge to 3/16" mild. All shears equipped with H.C. H.C. Blades for cutting Stainless.

INSIDE SLOTTER

8" Reach — 16" ga. cap. Makes inside slotting cutting faster, easier, cleaner. Punch and die arrangement of 5 blades assures accuracy, clean cutting action. Cuts 2½" x 1/16" slot at one stroke. Throat design permits pivoting work at any point in stroke for special inside cuts. Note sample cuts.

See your Beverly Dealer or write for illustrated catalog.



BEVERLY SHEAR MFG. CO., 3000 W. 111th St., Chicago 43, Ill.

For more data circle 583 on Postpaid Card

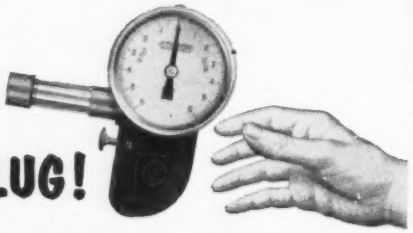
for intricate hand work. The Desoutter 70,000 r.p.m. turbine "03" grinder will grind, deburr, cut, polish and engrave.
For more data circle 123 on Postpaid Card

★ modern machine shop ★

OPTICAL JIG BORER

Amitool Co., Inc., 629 Main St., Westbury, L. I., N. Y., announces the Omega 1 Optical Jig Borer. Structural features include: base—a heavy walled, scientifically ribbed casting, providing an extremely stable foundation, with two vee ways of generous proportions, providing ample support for the saddle; table and saddle—very rigid, amply ribbed, providing widely spaced vee ways for compound movements. All plane and mating surfaces are perfectly hand scraped to the closest tolerances; main drive—consists of a 2 h.p. electric motor of standard voltage, coupled with an infinitely variable drive of the split pulley design, providing spindle speeds from 30 to 1,800 r.p.m., adjustable while running. A tachometer is provided to show the specific spindle speed required. A power take-off for quill feeds is also provided; brake—immediate braking action is provided so that the spindle may be stopped or locked for tool changing; sliding head—this unit was designed for easy handling and positioning. It slides on two vee ways and is adequately counterbalanced. The sliding head houses a hardened, ground and lapped liner of

Say good-bye to Guesswork Gaging!



HAND 'EM COMTORPLUG!

precision gage for holes ⅛" to 10" diameter

HERE'S WHO USES IT:

Aeresearch Mfg. Co	Hamilton Standard Division
Allison Div	Harris Seybold Co
Buick Motor Div	Homelite Corp
Century Electric Co	Int. Harvester Co
Chicago Pneu. Tool	Jacobs Mfg. Co
Chrysler Corp	Lycoming Spencer Div
Continental Motors	McDonnell Aircraft
Curtiss Wright	National Lead
Dana Corporation	Northrop Aircraft
Detroit Transmissions	Pontiac Motor Div
Douglas Aircraft	Scintilla Magneto
Fairchild Engine & Airplane Co	Steel Products Eng
Falk Corp	Studebaker Packard
Ford Motor Co	Sylvania (Atomic Div.)
General Electric Co	United Airlines
Warner Gear Div	

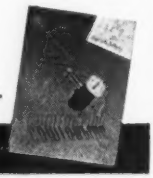
Large graduations easily read within .0001"

HERE'S WHAT IT DOES:

Shows exact hole size within .0001".
Detects front or back taper, ovality, bell mouth, barrel shape
A fixed — not passing — reading
Automatic features assure uniform gaging, free of user influence
Genuine 2 point gaging, automatically aligned and centered
Used at machine, on work still in chuck, on floor, at bench
Free from wires, air hose, electronic gear

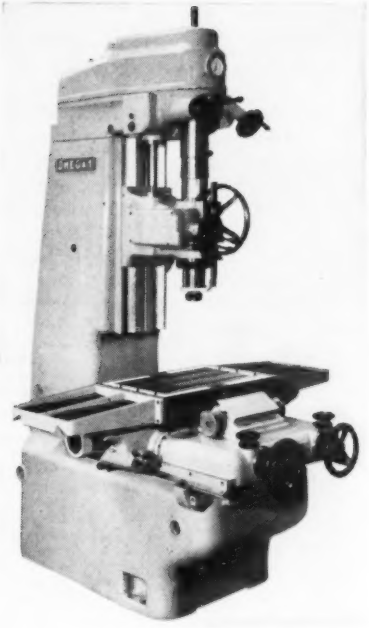
REASONABLY PRICED

SEND FOR BULLETIN 50 →
COMTOR COMPANY, 64 FARWELL ST., WALTHAM 54, MASS.



COMTORPLUG

For more data circle 584 on Postpaid Card



Omega 1 Optical Jig Borer is shown above

steel for quill guidance. The sliding head contains all the necessary controls for the spindle, hand and power feed, trips for depth control, safety feed clutch, graduated dial for depth measurement and single lever head locking device; spindle and quill—both are made of special steel, hardened. The quill is hard chromed to 75C Rockwell to insure long lasting accuracy. The spindle is completely ground and superfinished by a special machine. The quill assembly is counterbalanced by a counterweight and return spring system.

For more data circle 124 on Postpaid Card

★ modern machine shop ★

PORTABLE BROACHES

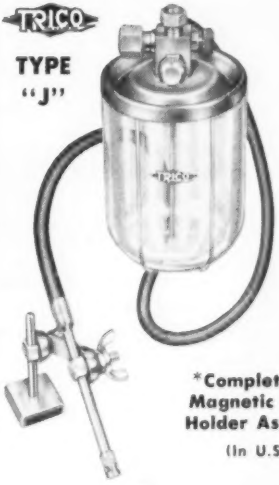
Availability of 28 portable broaches, designed to economically solve exact-

New! ONLY . . . $15*

BUYS THIS COMPACT MIST COOLANT UNIT

TRICO

TYPE "J"



***Complete With Magnetic Nozzle Holder As Shown**

(In U.S.A.)

Especially designed for small precision machinery used for drilling, tapping, sawing, grinding, etc. Up to 500% savings through increased cutting speeds and tool life. Check these quality features and write for complete details.

- ***—compact . . . measures 3" x 5"***
- ***—separate air and coolant controls***
- ***—convenient mounting stud***
- ***—attaches to existing shop airline***
- ***—shatter-proof 8 oz. reservoir***
- ***—neoprene flexible coolant line***
- ***—magnetic nozzle holder positions anywhere***
- ***—controlled discharge***

Larger Types and Capacities Available.

SEND FOR BULLETIN 37

TRICO FUSE MFG. CO.
MILWAUKEE, WIS. U.S.A.

For more data circle 585 on Postpaid Card

ing, high production machining problems demanding maximum stock removal and provide an extremely fine surface finish, is announced by California Broach Co., 664 South Anderson St., Los Angeles, Calif. The broaches incorporate a segmented helical pattern of cutting teeth to generate the full diametral cut. They are followed by a series of closely pitched teeth to produce a fine surface finish.

It is said that portable broaching produces holes free from radial lines, reduces stresses, facilitates irregular shaped holes and consistently obtains exacting tolerance with long tool life. Broaches may be resharpened to increase tool life. This new method of broaching eliminates costly equipment and fixtures.

California Broach Company produces portable broaches which are

5 machines in 1

LENNOX TRU-EDGE® METLMASTR

The "All American" Shearing, Forming and Piercing Machine

If you work in sheet or plate, here is the one machine that fits perfectly into your PROFIT picture! It eliminates costly dies and gives you complete operational versatility—Investigate now!

LM2

AVAILABLE IN THREE MODELS

Write today for complete information on the METLMASTR

LENNOX

TOOL and MACHINE BUILDERS

LENNOX Tru-Edge METLMASTR
Lennox-Demco Sensitive Drilling Machines
640 N. Baxter St. • Lima, Ohio

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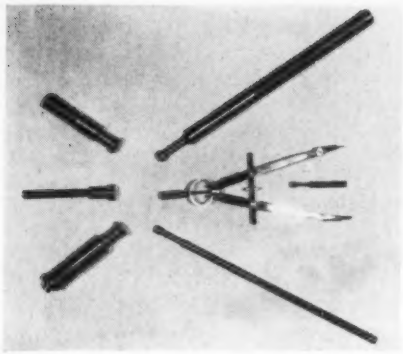
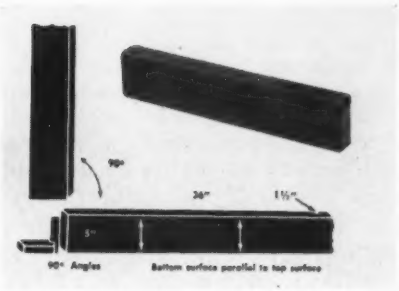


Shown above are various styles of broaches produced by California Broach Company.

suitable for broaching aluminum, steel, laminates and a wide variety of materials in diameters ranging from 0.250 to 0.6562 inch.

For more data circle 125 on Postpaid Card



Collins Black Granite Straightedge

BLACK GRANITE STRAIGHTEDGE

The new parallel straightedge 90 degree angle side is the latest offering of Collins Microflat Co., 3249 El Segundo Blvd., Hawthorne, Calif. This addition completes another phase of its program designed to provide industry with a complete line of black granite inspection equipment.

30 SECONDS PLEASE!

The WALTER PRECISION ROTARY TABLES are accurate to 30 seconds

With or without Dividing Discs

- HARDENED AND GROUND WORM GEARS, BATHED IN OIL FOR LONG LIFE AND ACCURACY
- POSITIVE LOCKING, GUARANTEED NOT TO AFFECT THE ACCURATE POSITIONING
- LOW CONSTRUCTION HEIGHT
- 6 Second Reading
- Available in 10", 12½", 15¾", 19¾", 25", 31½".

Write for catalog on Precision Dividing Heads

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PRECISION ROTATION

WALTER

NEISE MODERNTOOLS

For more data circle 587 on Postpaid Card

new shop equipment . . .

This one piece of equipment accomplishes three operations.

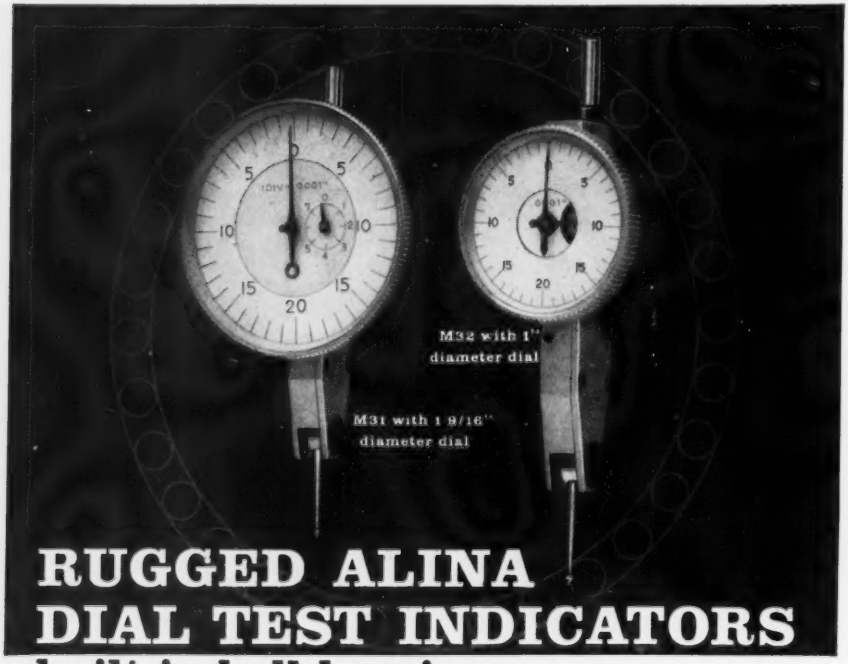
It checks squareness, parallelism and straightness, and is available in three grades: 25 millionths (laboratory grade), 50 millionths (inspection grade) and 100 millionths (toolroom grade).

For more data circle 126 on Postpaid Card

UNIVERSAL HYDRAULIC COPY SHAPER

Mercuria Co., 156 Burlington Ave., Clarendon Hills, Ill., announces the Anderle Copy Shaper, Type URK, which was designed to make punches, dies, electrodes (for spark erosion process), form tools and so on, from a template or any available master piece.

The shaper consists of a regular shaper ram and a sensitive, hydraulically controlled, universal table. The



RUGGED ALINA DIAL TEST INDICATORS

built-in ball bearings

for greater sensitivity—reduced pressure—improved accuracy

- Jeweled • Shock Proof • Range .032" • Graduated .0001"
- Reading 0-20-0 • Fully reversible contact point

Available with a wide variety of rectangular or round shanks.

The instruments shown here are part of a complete line of precision DIAL TEST INDICATORS of all types — Write for brochure!

ALINA CORPORATION

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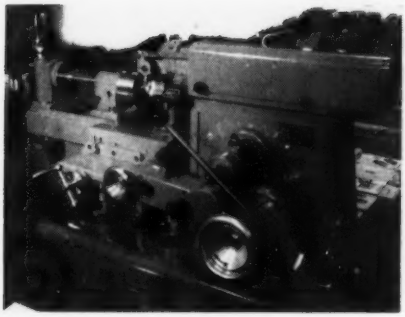
For more data circle 588 on Postpaid Card



Anderle Hydraulic Copy Shaper, Type URK

table is equipped with an infinite variable power feed for cross and circular motion. Every vertical deviation of the template is transferred on to the table within 0.0005 inch. Any profiled parts can be machined by automatic rotation (indexing) of the workpiece itself or by cross feed. In order to perform very difficult operations, the indexing and cross feed can be combined, so that the stylus device can follow the contour on the template. For normal machining of a workpiece without a template, the hydraulic system is used only for raising and lowering of the table. The generating of various operations is performed by indexing, cross feed and vertical feed of the tool.

For more data circle 127 on Postpaid Card

PORTABLE CENTRIFUGAL FILTER HANDLES COOLANT, CHIPS, OIL AND SLUDGE

Coolant Equipment Corp., Verona, Wis., recently announced a portable machine that will filter metal chips, fine suspensions and sludge from coolant and lubricating oils. This unit has been designed to service every machine tool in the plant and, also, to conserve valuable floor space.

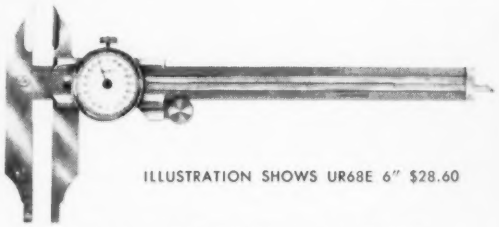


ILLUSTRATION SHOWS UR68E 6" $28.60

HELIOS High Precision Dial Calipers

- SAVE TIME
- SIMPLE — FAST
- ACCURATE READINGS
- NO EYE STRAIN

Also available in 8 and 10" sizes

Ask for catalogs on other HELIOS Calipers, Vernier and Dial, also HELIOS Parallels, Hole Gages, Telescope Gages, Radius Gages.

Karl A. Neise, Dept. MM-109,
404 4th Ave., New York 16, N. Y.

PRECISION MEASURING

Helios

NEISE MODERNTOOLS

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new shop equipment . . .

CeCOR Model 20T-NS Coolant Sump Cleaner

High vacuum, up to 275 inches water, produced in the tank body of this CeCOR Model 20T-NS Coolant Sump Cleaner draws the entire contents of the machine tool sump through the suction hose into a centrifugal filter basket. This method of sludge removal eliminates pump wear. Liquid contents of the sump are separated from solids and forced into the receiving tank. Filter basket has a capacity of 70 pounds for dry chips and sludge. Receiving tank holds 100 gallons of cleaned, reusable coolant or oil. Simple valve settings permit cleaned coolant to be returned to machine tool.

For more data circle 128 on Postpaid Card

★ modern machine shop ★

FURNACES FOR TRANSISTOR AND SEMI-CONDUCTOR INDUSTRIES

Hevi-Duty Electric Co., Milwaukee 1, Wis., announces several standard precision furnaces for the transistor and semi-conductor industries. These furnaces have proven successful in supplying the exacting temperature

GET THE BEST LAMINATED SHIM STOCK FROM BLAISDELL

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E NGINEERING specialists in design and application of laminated shims . . . and

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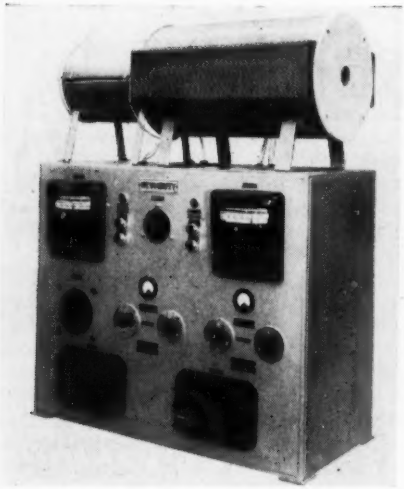

The Hevi-Duty Special Furnace Assembly

requirements necessary in the production of sensitive electronic components. They are available in three maximum temperature ranges; 1,850, 2,200 and 2,600 degrees Fahrenheit.

Excellent temperature uniformity can be obtained through multiple zone heating. Precise temperature selection is through saturable reactor controls. Controlled preheat and cooling zones can also be supplied.

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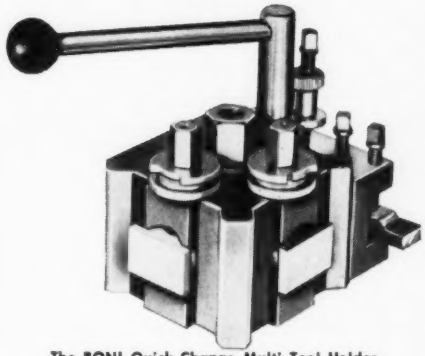
★ modern machine shop ★

CARTRIDGE TYPE SPINDLE ASSEMBLIES ARE AVAILABLE IN 28 STANDARD MODELS

A redesigned and expanded line of cartridge type, precision spindle assemblies is announced by Russell T. Gilman, Inc., 623 Beech St., Grafton, Wis. Available in diameters from 1.250 to 2.750 inches, the spindles are designed for mounting a variety of small cutting tools such as end mills, shank-type and center-hole milling

GUARANTEED REPETITION TO 0.0001"



The BONI Quick Change Multi Tool Holder for Lathes offers

- TREMENDOUS TIME SAVINGS
- FASTER WORK
- BETTER WORK
- RIGIDITY
- *5 Sizes which cover a large range of Lathes*

Karl A. Neise, Dept. MM-109
404 4th Ave., New York 16, N. Y.

HIGH PRECISION

BÖNI

MASTER MULTI-TOOL HOLDER

NEISE MODERNTOOLS

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IMMEDIATE DELIVERY!

KNOBS LEVERS WHEELS & HANDLES

Cadmium plated, large selection of styles and sizes. Specials on request. Send for FREE catalog.

MACHINE PRODUCTS *Corporation*

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Make 3 hammers AT ONCE!

It's the NEW, easy, economical, quick way to mold your own lead hammers on a production basis with "SHUR-GRIP" handles and this COOK production mold.

COMPLETE LEAD HAMMER SERVICE

Write for circular and prices

COOK'S LEAD HAMMER SERVICE

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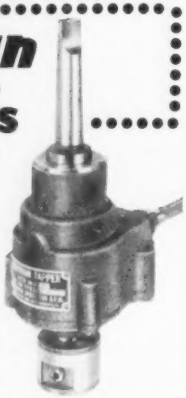
Dorman

Automatic Reverse TAPPERS



- Automatic Torque Control
- One minute to adjust
- Prevent tap breakage
- Easy to operate
- No skill required
- Wide Range of Tap Capacities
- No. 1A Friction Drive Tapper—capacity No. 2-56 to 3/8" in steel, 1/2" in aluminum. Also Positive Drive.
- No. 2B Positive Tapper—capacity 3/8" to 7/8" in steel.
- No. 3A Positive Tapper—capacity 1/2" to 1 1/4" in steel.
- No. 4A Tapper—capacity 3/8" to 2" in steel including pipe taps.

Write for Bulletins and information

Immediate Delivery

Priced from **$62.00**

Also Production Threaders with Round Split, Button or Acorn Dies.

Thriftmaster **PRODUCTS CORPORATION**

a Subsidiary of Thomson Industries, Inc.

1034 N. PLUM • LANCASTER, PENNA.

Also Adjustable and Fixed Center Drillheads

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cutters, drills, taps, reamers, counterbores, slitting saws and various special tools.

The 28 standard models offer a range of four basic sizes and two methods of mounting the spindle to the machine, along with five types of spindle nose — Morse taper socket, straight bore hole, Jacobs taper nose, arbor type nose and blank spindle end for machining by the user. With a cylindrical cartridge, spindle assemblies can be located in a bored hole in any machine casting of suitable size, or by means of one of the two types of standard Gilman precision mounting brackets.

For more data circle 130 on Postpaid Card

Gilman Cartridge Type Spindle Assemblies: (A) spindle with the positioning nuts for longitudinal location, (B) blank spindle end for modification by the user as required, (C) plain spindle without the positioning nuts, (D) with a Morse taper socket, (E) with a Jacob taper nose, (F) with a straight bore hole and (G) with a mounting arbor.

HIGH PRODUCTION MACHINE PERFORMS 41 OPERATIONS

Forty-one distinct operations are performed automatically on compressor heads by the Model 394-8 High Production Machine, manufactured by Morris Machine Tool Co., 2011 Eastern Ave., Cincinnati 2, Ohio. The horizontal rotary indexing machine utilizes a 48 inch diameter table and a ten station automatic hydraulic index to drill, ream, spotface, chamfer and mill 375 pieces per hour. The design cycles parts twice around the table, reducing the number of drill units required. Double fixtures are used. With each indexing, the operator removes a completed part from the second position of the fixture, transfers a part from the first to the second position, then loads an unfinished part into first position. Cycle time is 9.6 seconds.

The Morris Unit Type Machine Tool eliminates model changeover problems by incorporating standard production units. The 17 Cam-Matic Drill Units offer extreme flexibility.

Morris 394-8 High Production Machine

For more data circle 131 on Postpaid Card

ZIEGLER FLOATING TOOL HOLDERS

INCREASE TAPPING AND REAMING PRODUCTION

FAST SET-UPS — automatically compensates for misalignment up to 1/16" on dia. between machine spindle and work.

Free-Floating, Easy-To-Use Ziegler Tool Holders permit machine operators to maintain production without scrappage due to alignment inaccuracies, eliminate bell-mouthed and oversize holes and keep job set-up costs to barest minimum.

PROMPT DELIVERY

SIZES and types to fit all machines used for tapping and reaming.

Hold positive hole location tolerances

ZIEGLER TOOLS

SEND FOR YOUR CATALOG TODAY

W. M. ZIEGLER TOOL CO.

ROLLER DRIVE FLOATING TOOL HOLDERS

13562 Auburn
Detroit 23, Michigan

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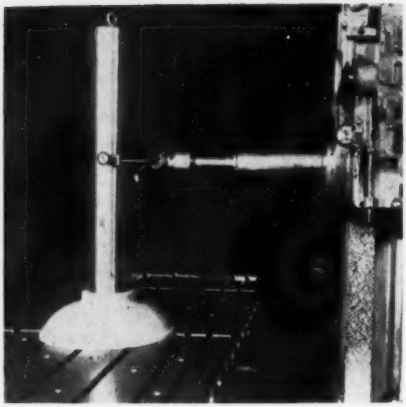
new shop equipment . . .

TOOL SIMPLIFIES VERTICAL ALIGNMENT OF MACHINES

A means for simplifying vertical alignment of machine tools is provided by the Tru-Plumb Tool, available from Davis Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The unit is an accurate, vertical, machined-steel column mounted on a 17 inch diameter base. Placed on a machine tool table, it serves as a reference for checking alignment of vertical and horizontal spindles, headstocks, columns, end supports and other machine components by means of dial indicators.



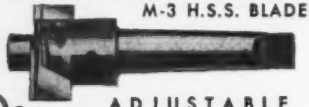
Davis "Tru-Plumb" Tool is shown in use

Tru-Plumb Tools are available in 36, 48 and 60 inch heights with accuracy of 0.0002 inch per foot of length. The large base minimizes problems of irregular table surface.

For more data circle 132 on Postpaid Card

HOLES

1" TO 4" DIA. WITH ONLY 5 TOOLS
M-3 H.S.S. BLADES



Clark ADJUSTABLE COUNTERBORES

P. O. BOX 990 BEVERLY HILLS, CALIFORNIA

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QUICKLY — on your SURFACE GRINDER — EASILY

RADIUS DRESSER $44.00 Diamond $8.00

ORDER DIRECT on our 10 day money back guarantee

ANGLE DRESSER $49.00 Diamond $8.00

Chatter Resistant, Spring Loaded Spindle

Hardened shaft—bearing adjustable for wear.
Diamond always perfectly centered.
Easily set adjustable 180° stops.
All surfaces ground true from hole.
CAPACITY—1½" convex to 4" concave.

10" Wheel size for DoALL and NORTON Grinders—$49.00. Diamond $8.00.

14", 20", 24", in stock, low price.

Ball Thrust Bearing.
24 Precision Ground Surfaces.
DIAMOND BLOCK Slides in Ground & Lapped Housing.
Set Accurately with Protractor or Sine Bar to 1" of Arc.
Largest Bearing Surfaces of any Angle Dresser.

The "Mighty Midget" Line

SPERMAN METAL SPECIALTIES • 2199A E. 21st ST. • BROOKLYN 29, N. Y.

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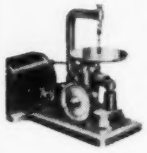
Positive Accuracy!

NEW HIGH SPEED

DIE FILING MACHINE



Positive accuracy is assured because files are held rigidly above and below table in yoke, which reciprocates on two hardened rods that move in accurately machined guide holes. Uses Standard 3½" or 4" Parallel Machine Files as small as 3/64" in diameter.

SPECS—Table diam. 6"; stroke 1"; throat 3½"; capacity 1½" material thickness; weight 50 lbs.; height 14"; motor ¼" H.P.; base 8¼"x19"; speed 375 strokes per minute.

HIGH SPEED HAMMER CO., INC.
315 Norton St., Rochester 21, N. Y.

For more data circle 598 on Postpaid Card

RAISE Your PRODUCTION 1500%!

SEE PAGE 31

High Pro '30'

By Veet

For more data circle 599 on Postpaid Card

NEW ADJUSTABLE BURRING TOOL . . . a handy vest pocket scraper and burring instrument. Blades are fully retractable, replaceable and easily sharpened. Cutting length adjustable to 3", can be reversed to use either end. Made from hi-quality, hi-speed tool steel for long life. Ideal for burring in aircraft and other light metal operations—overall length 4½". **Complete $2.54 ea. Min. order 6. Blades $12.50 doz.**

Write for Additional Information.

Dealer Inquiries Invited.

TITAN TOOL SUPPLY CO.
Box B, 1419 Hertel Avenue, Buffalo 16, N. Y.

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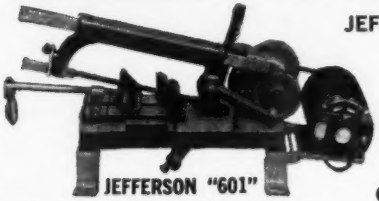
CUT your Cutting Costs with KELLER POWER HACKSAWS



JEFFERSON "601"

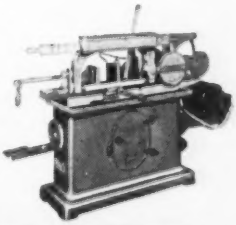
JEFFERSON "601" is a rugged, 4" x 4" capacity saw with 45° swivel vise, cast base, Oilite bearings throughout, replaceable bronze wear strip on guide bar, pressure relief on back stroke for longer saw life and other big saw features.

With motor, switch, wired, ready to go .... **$79.00** F.O.B. Factory.

KELLER No. 5 HY-DUTY 10½" x 9", Wet Cut.

A fast cutting, big capacity saw designed for continuous or intermittent duty. Features include a built-in coolant tank and pump, foot lift to saw frame, adjustable saw pressure, automatic lift on backstroke and many others.

Choose from 10 KELLER Models in 5 sizes—4" x 4", 5" x 5", 6¾" x 6¾", 8½" x 8½", 10½" x 9", wet or dry cut.



Ask your KELLER Dealer or write for descriptive Bulletin 257 TODAY

Sales Service Mfg. Co.

2361 University Ave. • St. Paul 14A, Minnesota

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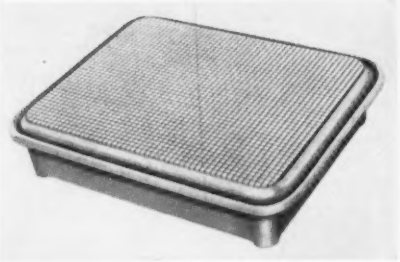
new shop equipment . . .

LAPPING PLATES

Fine grain lap iron lapping plates, available in four sizes with flatness held to 0.0001 inch, are announced by American Lap Co., 20184 Sherwood, Detroit 34, Mich. These plates are annealed and are heavily ribbed in order to assure retention of accuracy.



American Fine Grain Lap Iron Lapping Plate

An integrally cast trough around the outside edge catches excess lapping compound and prevents loss of expensive diamond dust.

The smallest size, 6 by 9 inches, is serrated to form ¼ inch squares on lapping surface, while larger sizes, 9 by 12, 12 by 15 and 15 by 18 inches, are serrated into ⅜ inch squares.

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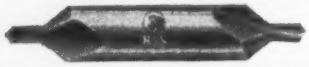
Combined Center Drills & Countersink 60°. Super HSS. Top Quality



No	Diameter Drill	Diameter Body	Length Drill	Length Overall	Price Each Right Hand	Price Each Left Hand
00	0.020"	1/8"	3/64"	1 1/16"	$1.35	$1.70
01	0.025"	1/8"	3/64"	1 1/16"	1.10	1.50
0	1/32"	1/8"	1/16"	1 1/16"	.95	1.30
1	3/64"	1/8"	1/32"	1 3/8"	.80	1.00

Delivery from stock. No. 2 & 3 also av.

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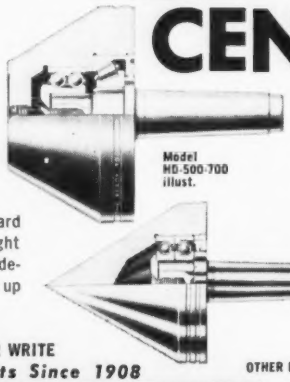
BULL PIPE

LATHES: 30 MODELS
GRINDERS: 22 MODELS

Stocked in all standard taper sizes and straight shanks. Immediate delivery on head sizes up to 12" dia.



Model HD-500-700 illust.

FEATURE: 3 & 7 ABEC-SPEC bearings. Heads made of chrome nickel steel, hardened for greater resistance to abrasion wear. HD model has an adjustable bearing assembly with positive locking control.

OTHER HEADS AND SHANK SIZES AVAILABLE

CALL YOUR DISTRIBUTOR OR WRITE

Center Specialists Since 1908

RED-E-TOOLS **READY TOOL COMPANY**

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Stratford, Conn.

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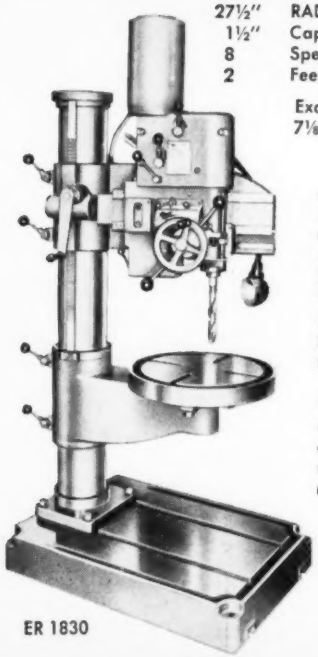
ARBOGA

DRILL PRESSES

MADE IN SWEDEN



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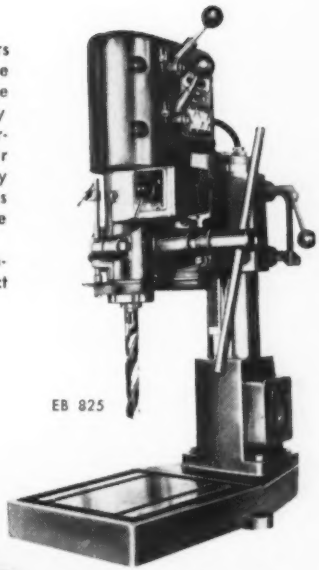
27½" RADIAL DRILL
1½" Capacity in steel
8 Speeds, 80-890 r.p.m.
2 Feeds

Exclusive drill ejector
7⅛" dia. Column

Any of our 100 dealers across the country will be proud to show you these and the other quality drill presses in the Arboga line. There are over 98000 now in use—many completing as much as 25 years of dependable service.

Call any of the numbers below, or contact our home office for more information.



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8 SPEED DRILL PRESS

18" or 24" Swing
1" Capacity in steel
125—1540 RPM,or higher
Exclusive drill ejector

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where to get it

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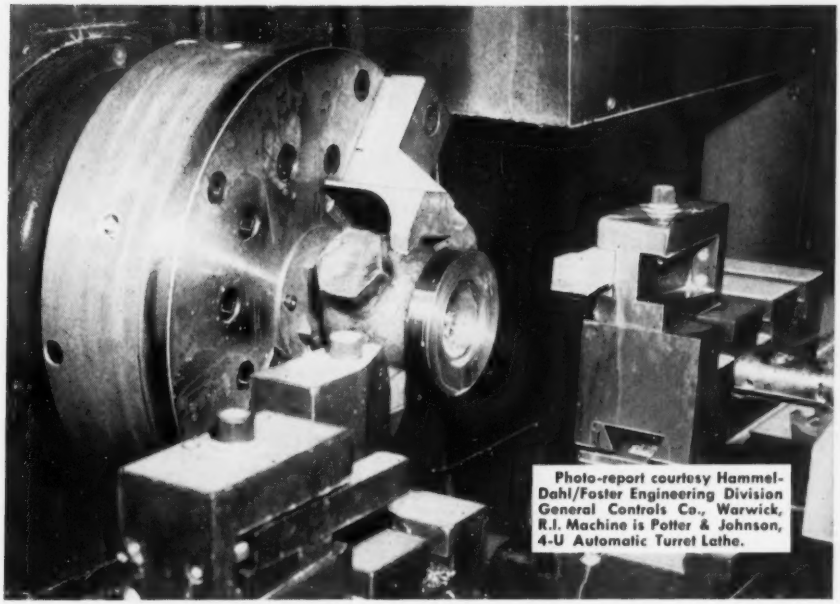
SMART TOOLING



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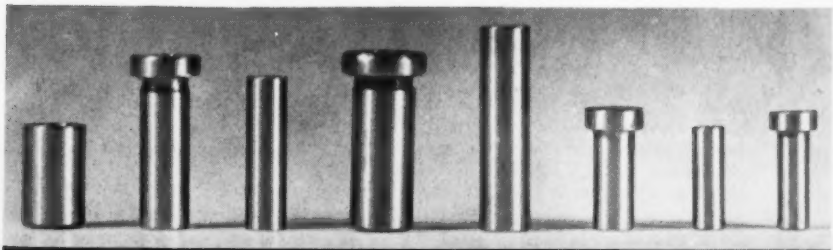

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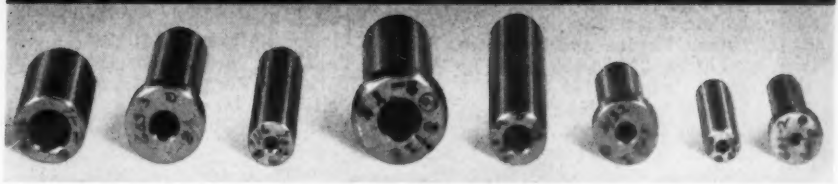

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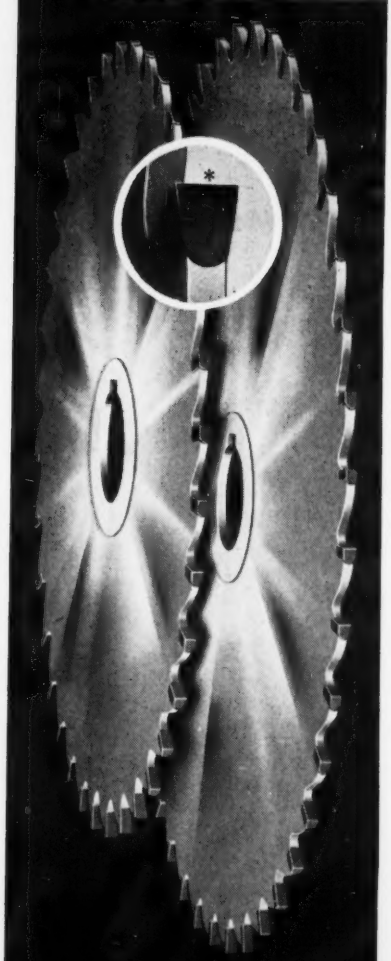

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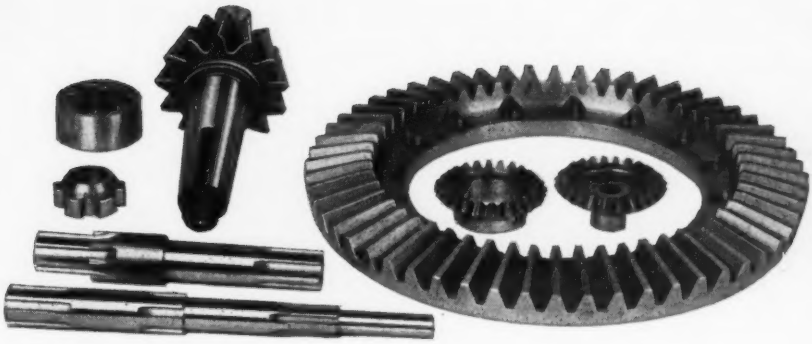

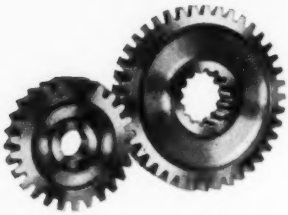

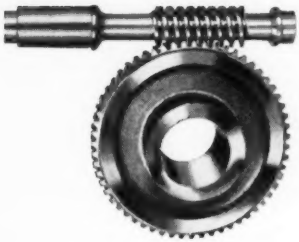

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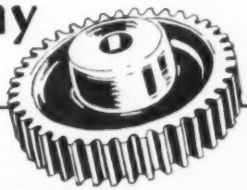

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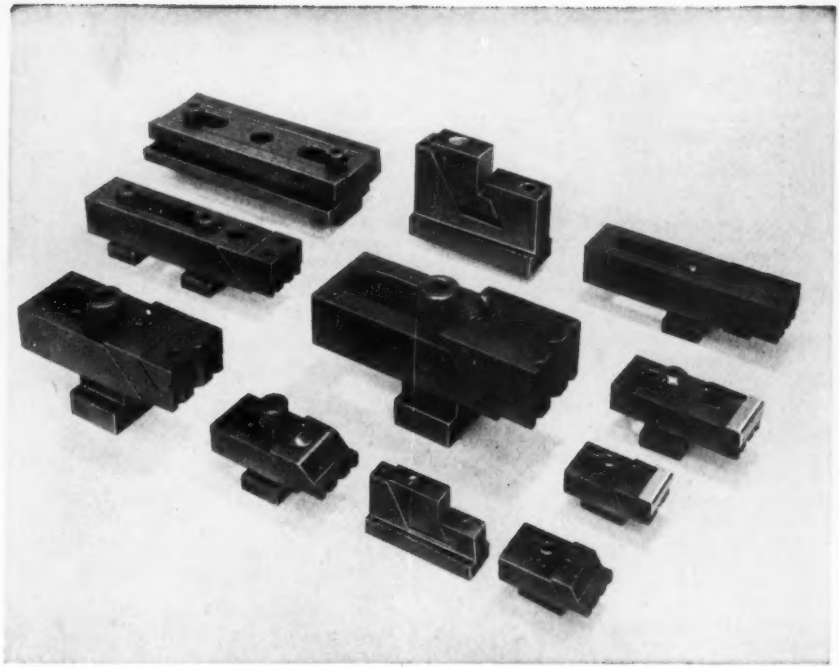

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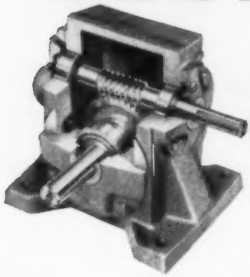

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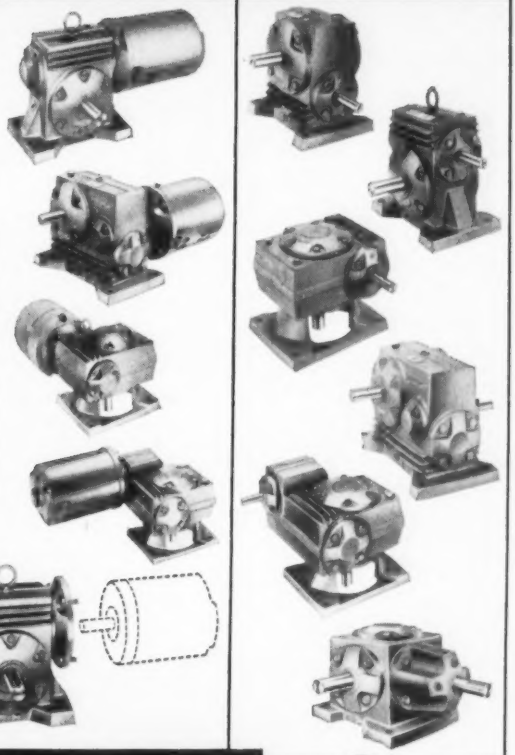

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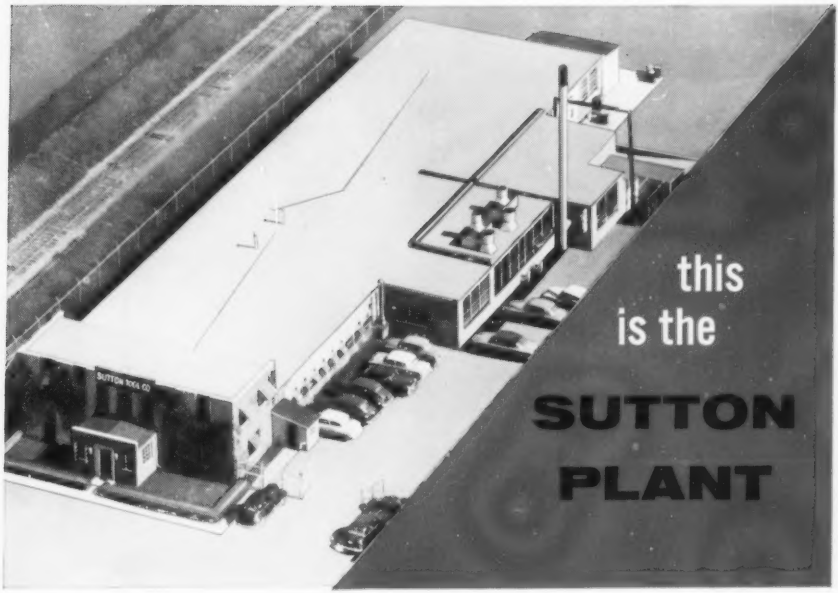

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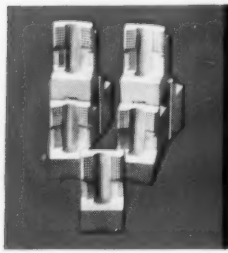

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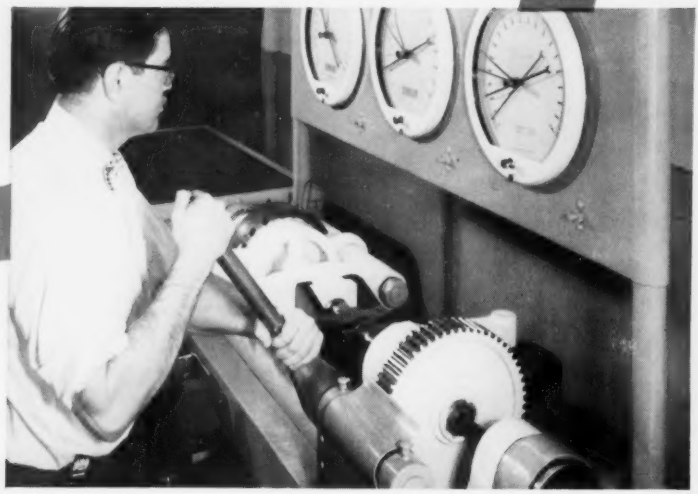

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